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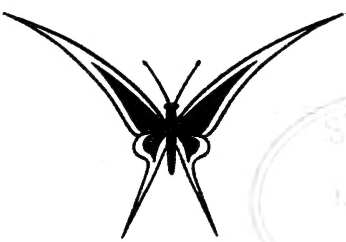

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30 August 1962

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NOTES ON *ERORA* (LYCÆNIDÆ)

by KILIAN ROEVER

Prior to 1940 all the *Erora* occuring in the United States were considered to be *Erora læta* Edwards. The range at that time was known to be curiously disjunct. An eastern population occuring from Ontario and Nova Scotia south to Virginia and a southwestern population occuring in Arizona were known. Dos PASSOS (1940) described the population in Arizona and New Mexico as *Erora læta sanfordi.* He made no mention of *Erora quaderna* (Hewitson) so I presume no Mexican *Erora* were examined.

FIELD (1941) affiliated the Arizona population with *Erora quaderna* which was described from Mexico in 1868 and listed *Erora læta sanfordi* dos Passos as a synonym. FIELD's decision was based apparently on the original description and on the description found in the *Biologia Centrali-Americana.* He also made no mention of examining any *Erora* from Mexico. FIELD treated *Thecla attalion* Godman & Salvin as a dimorphic form of the male of *quaderna,* the name being based on a form lacking the green color on the ventral wing surfaces. He cautioned that such specimens lacking the green beneath may not occur in nature except in a worn condition. It has been my experience with *quaderna* in Arizona that the green overscaling is easily removed leaving a brownish-buff color on the undersurfaces. In view of this it seems that *attalion* can remain in synonomy.

CLENCH (1943) revived *sanfordi* as the subspecies of *quaderna* occuring in the southwestern United States. His opinion was primarily based on the comparison of two *quaderna* specimens from Tancitaro, Michoacan, Mexico with Arizona material. CLENCH selected Tancitaro as the type locality because the type of *quaderna,* a female in the British

Museum, carried no accurate data. Unfortunately CLENCH failed to give any characters by which *quaderna quaderna* and *quaderna sanfordi* could be separated.

In an attempt to learn the diagnostic characters separating the subspecies I borrowed from the Museum of Comparative Zoology the two females (Tancitaro, Michoacan, Mexico, 7800′, VI-30-41 and VII-8-41, resp.; H. HOOGSTRAAL and R. HAAG, collectors) which CLENCH had examined. In addition Dr. TARSICIO ESCALANTE kindly loaned me two females (Desierto de los Leones, approx. 7500′, Distrito Federal, Mexico, I-45 and II-23-61). These four specimens from central Mexico were compared with a series of *Erora* from various localities in southern Arizona. The variation of the Arizona material clearly encompasses the Mexican material. On the basis of my comparison I consider *sanfordi* to be a synonym of *quaderna,* as did FIELD. I shall add that in a series of forty females from Madera Canyon, Santa Rita Mts., Santa Cruz Co., Arizona, there is considerable variation in the amount and shade of blue on the dorsal surface and in the size of the orange spots on the ventral surface.

In giving the distribution of *quaderna* within the United States FIELD (1941) lists Arizona, Utah, and New Mexico. I have been able to find no further record concerning the occurence of this species in Utah. DOS PASSOS (1940) records two specimens received from R. T. KELLOGG of Silver City, New Mexico. LLOYD M. MARTIN (*in litt.*) states that there is one specimen in the Los Angeles County Museum collection bearing the label data: III-22-40, Providence Mts., San Bernardino Co., California, T. B. BLEVINS, JR., collector. This is an entirely different environment from that in which it occurs in Arizona.

In 1960 I located a specimen of *quaderna* in the collection at park headquarters of Big Bend National Park. The data on this specimen, a female, were Big Bend National Park, Brewster Co., Texas, VI-12-37, ROLLIN H. BAKER, collector. To my knowledge this represents the first record of this species from Texas and is a considerable eastward range extension.

The data of my *Erora quaderna* collections in Arizona are as follows: APACHE COUNTY: Trout Creek Road, 4-6 mi. S of Smith Park, approx. 7500′, VII-4-58, 3 males; VII-4-59, 4 males; VI-25 & 26-60, 4 males, 1 female; VII-22-61, 1 male, 3 females. COCHISE COUNTY: E. Turkey Creek Canyon, approx. 3 mi. E of Onion Saddle, Chiricahua Mts., 6400′ IV-10-59, 2 males, 10 females, IV-15-60, 12 females. Pinery Canyon, Chiricahua Mts., IV-15-60, 2 males, 4 females. 1 mi. NW of the Southwestern Research Station, Chiricahua Mts., IV-15-60, 4 females. 1 mi.

N of Rustler Park, Chiricahua Mts., VI-19-60, 2 males. COCONINO COUNTY: Oak Creek Canyon, 7 mi. N of Sedona, III-28-59, 1 male. Todd's Lodge, Oak Creek Canyon, VII-16-61, 1 female. GILA COUNTY: Peterson Ranch, 7000′, Sierra Ancha, VII-2-60, 2 females. Tonto Creek Fish Hatchery, VI-28-61, 1 male. GRAHAM COUNTY: Wet Canyon, 6000′, Pinaleno Mts., IV-23-61, 2 females. GREENLEE COUNTY: Rt. 666, 8 mi. S of Hannigan Meadows, VII-5-59, 6 males. Gray's Peak Road Camp, Rt. 666, VII-5-59, 5 males, 1 female. PIMA COUNTY: Madera Canyon, Santa Rita Mts., 4400-4600′, III-8-59, 1 male; III-19-60, 3 males. Summerhaven, 7800′, Santa Catalina Mts., V-24-59, 1 male; VII-9-61, 1 female. PINAL COUNTY: Peppersauce Wash, 5000′, Santa Catalina Mts., IV-18-61, 1 female. SANTA CRUZ COUNTY: Madera Canyon, Santa Rita Mts., 5600-6400′, III-29-59, 3 males; IV-9-59, 4 males, 28 females; IV-10-59, 1 male, 32 females; IV-3-60, 8 females; IV-9-60, 3 females; VII-6-60, 2 males, 7 females; VII-9-60, 4 females; VII-13-60, 2 females; IV-6-61, 12 females.

All of the known records of *quaderna* in Arizona are from the isolated mountain ranges in the southeastern part or from the Mogollon Rim area which extends in an irregular line from near Sedona eastward to McNary, then southeast to the vicinity of Glenwood, New Mexico. In addition to the counties previously mentioned it has been recorded by others from several localities in Yavapai County.

The flight peaks seem to fall during the first two weeks of April and again during late June and the first week of July. Captures range in elevation from 4400′ to 7800′ although *quaderna* was encountered most frequently from 5500′ to 7500′ in the oak and pine zones. The collections I have made indicate that females are more abundant than males by a 3:1 ratio. In the case of *læta,* females are also reported more frequently than the males. This unequal sex ratio may be only a result of incomplete sampling methods.

Erora quaderna is readily attracted to the flowers of *Ceanothus fendleri* Gray. I have also taken it on the flowers of *Prunus virens* (Woot. & Standl.), *Nolina microcarpa* Wats., and *Monarda* sp. It is not unusual during early April in Madera Canyon to see several hundred specimens during the course of a day. At that time of year they are easily taken at damp spots along the stream or in flight along the road and trails. The flight has been noted to move down the canyon unless a strong wind was blowing.

Several present day workers consider *quaderna* may be conspecific with *læta.* I am not prepared to comment on this relationship since I have examined only two speciments of the latter. A key character that

has been cited for distinguishing males of these two species is the absence of a blue tornal patch on the dorsal surface of the hindwing in *quaderna* and its presence in *læta*. This is not a consistant character as I have five males of *quaderna* which exhibit a conspicious tornal patch.

I have not been successful in locating the foodplant of *quaderna*. The foodplants of *læta* have been listed as *Fagus* (beech) and *Corylus* (hazlenut). According to KEARNEY & PEEBLES (1960) no members of these genera occur in Arizona.

The southernmost record of *læta* that has been published was of a female taken along the Little River, 3000′, Great Smoky Mountains National Park, Sevier Co., Tennessee, IV-15-38 by ARTHUR STUPKA, the park naturalist (Field, 1941). While checking collecting records at the park headquarters of the Great Smoky Mountains National Park I found reference to a specimen of *læta* taken VII-17-36, on Andrew's Bald, 5860′, G.S.M.N.P., Swain Co., North Carolina, SIEBERT & EVANS, collectors. This is the first record of this species in North Carolina. It also represents an altitudinal high and the southernmost record for the United States.

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THE GENETICS AND REPRODUCTIVE ISOLATING MECHANISMS OF THE *PIERIS NAPI - BRYONIÆ* GROUP

by Z. Lorkovic

I. Introduction

The case of *Pieris napi* L. and *bryoniæ* Ochsenheimer has wasted much ink in arguments among taxonomists as to whether *bryoniæ* is a distinct species or only a subspecies of *napi*, without having brought about a satisfactory explanation. Even after the extensive work of Muller and Kautz (1938), a turning-point in the opinions on this problem, the situation remained rather unchanged for a more critical or biologically trained judge, familiar to some extent with the circumstances in this difficult group. This failure is mainly due to the fact that most early investigators as well as Muller and Kautz themselves have not used the genetic approach. The research of B. Petersen (1948-1955) offered a first refreshing exception, and his important conclusions anticipate some of those reached in the present paper. Nevertheless a more exhaustive genetic analysis of the *napi* - *bryoniæ* complex remained necessary. In fact, at the same time as I was about to publish my genetic research obtained some years ago, several articles of Bowden appeared (1955, 1956, 1957, 1958) containing also some genetical and experimental data about the questions involved, though a conclusive genetic survey has not been given. Besides this, his results differ in some respects so much from my own that it will be by no means unnecessary to show here the results of my investigations in the usual genetic way.

The Problem. The main attractive point for the taxonomist lies in the great color differences between the females of these two forms as well as in the geographic restriction of *bryoniæ* to the Alps, Carpathians, Scandinavia, and to some less known parts of Asia and North America. On the other hand, *napi* is widely distributed in both the plains and the mountains of the Palæarctic and Nearctic Regions but usually does not appear in the areas of *bryoniæ*. Because of its restricted boreal - alpine distribution and the occurrence of more or less common transitions towards *napi*, *bryoniæ* was in the past considered to be an ecological race of *P. napi*. However since Muller and Kautz have in their extensive work offered certain arguments in favor of the specific distinctness of the two forms, their view has gained more and more adherents among lepidopterists, so that finaly Forster and Wohlfart in their work *Die Schmetterlinge Mitteleuropas* (1955) quoted *bryoniæ* as a good species,

although the problem has not reached its conclusive stage. My use here of the term "adherents" suggests that we are not concerned with a systematically simple case, but rather with one that is in some respect ambigous. Such cases of controversial opinions have much interest from the evolutionary point of view, because this fact itself suggests that we are dealing with an incomplete stage of speciation, which deserves a closer analysis, especially from the genetical and populational aspect.

The present paper refers to my research concerning the genetics of the morphological characters of *napi* and *bryoniæ*, to the occurrence of recombinations of these characters in nature, to the possible and experimental hybridisation and to the degrees of reproductive isolating mechanisms between the two forms.

II. GENETICS OF COLOR DIFFERENCES BETWEEN *P. bryoniæ* AND *P. napi*

MATERIALS AND BREEDING METHODS. The crossings were performed with the ssp. *neobryoniæ* Sheljuzhko that is abundant in the Alpine parts of western Yugoslavia and with *napi* from the lowland districts of the environments of Zagreb, where no *bryoniæ* occur. Some crossings were also obtained with Alpine *napi* captured in districts where they fly together with *bryoniæ* (Krnica Valley, Rateče, Planica). During 1947 - 1951 about 200 broods were reared to imagos and more than twice as many matings have been carried out. Previously (1926, 1931, 1954) broods from wild females occasionally captured at the lower situated localities of *bryoniæ* (Fala, Savinja valley, Krnica below Prisojnik) served rather as an orientation for further decisive research.

The matings were obtained always under the experimentator's control either inside the laboratory, mostly at the windows, or outdoors in the net, sometimes also free in the field. Many pairings could be realised only by the authors' artificial copulatory method using clamped females and immobilised males (Lorković 1948, 1952). The mating usually lasted 1 to 1½ hours. The egg-laying females were kept in cages provided with a cotton net and the eggs were deposited on the potted food plant *Roripa silvestris,* where the larvæ remained until the last molt. Subsequently the larvæ were transported to plants kept in water. The plants must be changed every one or two days whether they are eaten by the larvæ or not. By this way the losses caused by diseases were reduced practically to zero. The pupation occurred on the walls of the cage or in cardboard boxes, where the larvæ were placed after they had stopped feeding. Emerged male imagos usually were kept in cardboard boxes about 15 × 15 × 30 cm for two or three days at a lower temperature (15°

- 18°C) wherefrom they were liberated once daily for some minutes for feeding. In such a manner the males can be kept in good condition before they become ripe to mate; this usually takes two or three days before one may with great probability count upon the mating ability of a male. On the contrary, the females are able to mate as soon as their wings grow strong enough for flying. Older females are more convenient only in the case when the artificial pairing methods must be used.

Genes affecting the wing colour of *bryoniæ* and *napi*. The first clear and doubtless assertion about the inheritance of the main *bryoniæ* character, i. e. the dark melanic markings along the wing veins in *bryoniæ* females (these are missing in *napi*) has been expressed in Petersen's paper (1955), where on the strength of my unpublished research he reported that the *bryoniæ* character is dominant over that of *napi*. A short note appeared previously to the paper mentioned in the *Proceedings of the IX. International Entomological Congress* (1952), where I declared in the discussion of Hesselbarth's report that the *bryoniæ* pattern is dominant, whereas the inheritance of the brownish yellow color is intermediary. All other previous opinions about this matter, so far as is known to me, were uncertain, which is no wonder, for without reared F_2 generation or back-crosses such a decision could not be reached. In fact, nearly all previous breeders, as well as some recent ones, suffered great losses caused by diseases, owing to the faulty breeding methods, so that the poor F_2 broods were not sufficient for an accurate genetical analysis. One exception was Main's crossing between 1907 and 1909, but in spite of a satisfactory breeding method he reached a quite erroneous conviction "that the inheritance of *bryoniæ* characters passed almost entirely through the female" (quoted after Bowden, 1956). After this failure it was not earlier than in 1956 that Bowden published the first successful research on this matter, and his results agree in general with my own. In respect to the lacks in the genetic interpretation of the crossings in his paper I shall give here a genetical analysis of my crossings in connection with the question of the reproductive isolation of these two butterflies.

The following crosses have been carried out by the author:

napi ♂ × *bryoniæ* ♀	Brood
1. 1932: ♂ Podsused (Zagreb); ♀ Rogovilec, Savinja valley, Karawanken Alps	R × P
2. 1947: ♂ Maksimir (Zagreb); ♀ Vršič, Julian Alps, 1400 m.	III
3. 1948: ♂ Maksimir (Zagreb); ♀ Vršič, *ex larva* 1947	1 bn

bryoniæ ♂ × *napi* ♀

4. 1935: ♂ Mangart, Julian Alps; ♀ Podsused (Zagreb) M × P
5. 1948: ♂ Vršič, *ex larva* 1947; ♀ Peričnik, Vrata valley, Julian Alps, 900 m. 3 nb
6. 1948: ♂ Krnica, Julian Alps, 1100 m.; ♀ Mt. Sljeme (Zagreb), 600 m. (27)5

Besides the listed crossings, several *bryoniæ* broods from various localities of the Julian Alps and the Karawanken Alps in the Yugoslav part of the southeastern Alps have been carried out, *i. e.* from: Žirovnica, 700 m.; Fala near Maribor, 300 m.; Rogovilec in Savinja valley, 650 m.; Vrata valley in the Julian Alps, 800 m.; Vršič and Mojstrovka in the Julian Alps, 1400-1800 m.; and Bovec in the Trenta valley, 600 m. *P. napi* were mostly used directly from nature, since *napi* is the species of the environment of Zagreb, ranging eastwards to the line Maribor - Zidani most approximately, where the last small populations of a light *bryoniæ* can be found.

The most important genetic results were obtained from the cross "III" which could be brought up to the 14th generation without introduction of any new *bryoniæ* blood, but with 7 refreshments of outdoor *napi.*

The recent analysis of these crossings confirmed the author's previously mentioned remarks about the inheritance of the main *bryoniæ* and *napi* characters. The three taxonomic distinctions between these two forms are controlled by three independent pairs or groups of genes: 1) An autosomal gene pair controls the extension of the dark MELANIC COLOR along the wing-veins; its dominant allele, *B,* causes the *bryoniæ* females to be heavily infuscated along the veins, whereas with the recessive allele, *b,* characteristic for *napi,* the darkening along the veins is either absent or reduced to the outer (distal) part of the veins (Fig.1 ♀♀). In the male sex the manifestation of these alleles is only slight, it is similar in both forms and therefore markedly sex-controlled. 2) The BROWNISH-YELLOW GROUND COLOR of *bryoniæ* females, and the WHITE one of *napi* controlled by another pair or group of genes, *Y, y,* and its expression is strongly sex-controlled, since the males are completely white. 3) A third pair of alleles, *W, w,* affects the WHITE OR GREENISH-YELLOW GROUND COLOR of the underside of the hindwings and the apex of the forewings, especially in males, and is thus partially sex-controlled.

We shall now turn to the more detailed analysis of each of the mentioned gene-pairs.

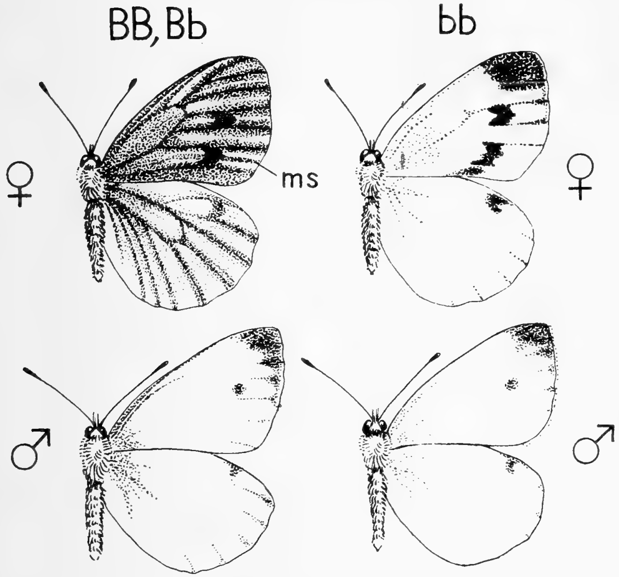


Fig. 1. Melanic wing color pattern in females and males of *bryoniæ* (left) and *napi* (right) which are controlled by the allele pair *B* and *b*.

THE *B, b* ALLELES. The main controversy concerning the allelic pair *Bb* which controls the principal feature of *bryoniæ* against *napi* is the question of its dominance. Because of the fact that the *bryoniæ* × *napi* hybrids show a less pronounced *bryoniæ* pattern than the pure *bryoniæ* it was believed earlier that this character behaves intermediately. Such opinions rest on a misinterpretation of the meaning of dominance. This term does not denote full identity with the parental phenotype, respectively the homozygous one, since there are all transitions between the complete dominance to none at all. In our case, by pairing homozygous *bryoniæ* and *napi,* the F_1 generation of both reciprocal crossings is always of the *bryoniæ* pattern, although a somewhat slighter one. In the F_2 or any later generation, when individuals heterozygous for the genes *Bb* are mated, *bryoniæ* and pure *napi* segregate in a 3 : 1 ratio. In backcrosses the segregation is likewise clear, and the ratio is 1 : 1. In Fig.2 the succession of 14 generations obtained in the stock "III" is represented diagrammatically. The genotypes of each brood or of the parents as

Fig. 2. Diagrammatic representation of 14 successive generations in the stock "III" of the *napi* ♂ × *bryoniæ* ♀ crossing. During this time only *napi* were introduced from outside. The actual ratio of phenotypes is indicated for each brood; the expected genotypes are indicated by black (*BB*), black and white (*Bb*) and white (*bb*). Male and female symbols show approximately the given ratio. The bold black lines indicate broods in which all individuals were of *bryoniæ* phenotype, consequently at least half of them were homozygous.

indicated in the diagram result from actual ratios obtained in the progeny of each brood as well as by the symbols of male and female phenotypes. The four possible ratios which occurred in 54 broods are summarized in Tables 1 – 3, each brood containing not less than 15 individuals; broods with a lower number of descendants are not included, except a few which are of special interest.

Table 1. *Bb* × *Bb*. Expected 3 : 1 ratio.

Brood	Ratio									χ^2
	B♂	:	*b*♂	*B*♀	:	*b*♀	*B*♂♀	:	*b*♂♀	
M×P – 1935	14	:	2	8	:	3	23	:	5	0.762
III – 1947	2	:	0	4	:	3	6	:	3	0.333
6/III$_4$ – 1948	7	:	0	6	:	3	13	:	3	0.333
2/4b – 1948	13	:	2	6	:	4	19	:	6	0.013
9 – 1948	12	:	3	11	:	5	23	:	8	0.011
128 – 1949	10	:	2	2	:	1	12	:	3	0.200
201 – 1949	11	:	3	22	:	5	33	:	8	0.657
214 – 1949	11	:	5	12	:	1	23	:	6	0.287
247 – 1950	12	:	4	11	:	3	23	:	7	0.044
265 – 1950	15	:	6	14	:	6	29	:	12	0.202
289 – 1950	21	:	8	4	:	1	25	:	9	0.039
301 – 1951	15	:	3	10	:	5	25	:	8	0.010
307 – 1951	11	:	4	4	:	2	15	:	6	0.142
5bn – 1948	3	:	2	3	:	3	6	:	5	2.455
Total:	157	:	45	117	:	45	274	:	90	0.015
Expected ratio:	151.5	:	50.5	121.5	:	40.5	273	:	91	

Table 2.

A. *BB* × *BB*, *BB* × *Bb*, *BB* × *bb*.
Expected 1 : 0 ratio.

Brood	Ratio		
46 - 1949	44	:	0
53 - 1949	40	:	0
73 - 1949	16	:	0
45 - 1949	27	:	0
127 - 1949	29	:	0
134 - 1949	35	:	0
167 - 1949	11	:	0
210 - 1949	58	:	0
231 - 1950	28	:	0
237 - 1950	18	:	0
241 - 1950	68	:	0
271 - 1950	22	:	0
- 1950	37	:	0
315 - 1951	26	:	0

B. *bb* × *bb*.
Expected 0 : 1 ratio.

Brood	Ratio		
	0	:	14
3/III$_5$	0	:	6
	0	:	20
14/2/4b	0	:	17
213 - 1949	0	:	15
235 - 1950	0	:	17
255 - 1950	0	:	11

Table 3. ♂ *Bb* × ♀ *bb*, *and* ♀ *Bb* × ♂ *bb*. Expected 1 : 1 ratio.

Brood	Ratio B♂	:	b♂	B♀	:	b♀	B♂♀	:	b♂♀	χ^2	Sex of *bb* parent
RxP$_1$-1932	11	:	10	28	:	30	39	:	40	0.068	♂ [1]
RxF$_3$-1932	—	:	—	11	:	12	11	:	12	0.010	♂
1/III-1947	7	:	4	3	:	7	10	:	11	0.046	♂
3/III$_3$-1948	21	:	13	12	:	17	33	:	30	0.142	♀
6/III$_3$-1948	2	:	5	5	:	3	7	:	8	0.066	♀
1/III$_4$-1948	13	:	12	14	:	8	27	:	20	1.043	♂ [2]
4/III$_6$6-1948	8	:	10	7	:	4	15	:	14	0.035	♂
bbn-1948	4	:	5	3	:	2	7	:	7	0.000	♂ [3]
165-1949	4	:	3	3	:	3	7	:	6	0.077	♀
185-1949	4	:	9	11	:	5	15	:	14	0.035	♂
205-1949	12	:	8	5	:	12	17	:	20	0.242	♂
206-1949	5	:	6	7	:	6	12	:	12	0.000	♂
236-1950	3	:	3	3	:	4	6	:	7	0.076	♂
239-1950	13	:	11	8	:	12	21	:	23	0.091	♂
264-1950	6	:	6	3	:	4	9	:	10	0.052	♀
278-1950	7	:	10	8	:	6	15	:	16	0.032	♀
284-1950	8	:	3	5	:	8	13	:	11	0.666	♂
312-1951	13	:	5	6	:	8	19	:	13	1,125	♂
313-1951	10	:	6	4	:	7	14	:	13	0,036	♂
Expected ratio:	151	:	129	146	:	158	297	:	287	0.171	
Total:	140	:	140	152	:	152	292	:	292	0.50>P<0.70	

[1]The greater part of young larvæ was abandoned.
[2]Several *napi* females were accidentaly lost.
[3]*bryoniæ* ♂ *ex larva* from Vršić, 1947.

The Chi-squared test and the probabilities (P) of the ratios 3 : 1 and 1 : 1 convincingly prove that the difference between the *bryoniæ* and *napi* pattern depends on only one single pair of alleles and that the *bryoniæ* pattern is dominant over that of *napi*. Accordingly, the *napi* individuals are always homozygous, *bb*, and consequently pure-breeding; *bryoniæ* can be either homozygous or heterozygous. It can be seen from the diagram of Fig.2 that the mother of the stock "III" was heterozygous, since her progeny segregated in 6 *bryoniæ* and 3 *napi*, a quite unexpected fact for a high-alpine *bryoniæ*, usually considered to be true-breeding. It must be pointed out that in all these broods a clear-cut discontinuity between the *bryoniæ* and *napi* patterns was absolute, although *bryoniæ* vary considerably. The best but by no means the only decisive diagnostic character which allows the clear distinction between bearers of *B* and *b* has been found in the so called "margin-streak" ("Saumstrich" of MULLER

and KAUTZ or BOWDEN's "bryo-streak"), *i. e.* the dark suffusion along the rudimentary vein A_1, extending from the posterior discal spot to the outer wing margin (Fig.1, ms). This streak is so rarely to be found in *napi,* that when it is present it is more than probable that it originates from a previous mixture with *bryoniæ.* It is present nearly always not only in each similarly patterned subspecies or species as *adalwinda* Fruhst., *bicolorata* Petersen, *pseudobryoniæ* Vrty., *camtschadalis* Röb., and *ochsenheimeri* Stgr., but in *Pieris melete* Mén. too. Spring *napi* females which show a more marked gray suffusion along the veins than is usual in this species are also distinguishable by the lack of this streak. The distinction between a slightly marked heterozygous *bryoniæ* female and a more strongly marked *napi* would be sometimes difficult without the bryo-streak present in the former and absent in the latter. In general, there is a good correlation between the vein markings and the bryo-streak in *bryoniæ,* the streak being a more reliable diagnostic character inasmuch as it is a qualitative one. One exception to this rule will be considered below. It may be also emphasized that the occurrence of the bryo-streak does not depend upon the presence of the posterior discoidal spot, since the streak can be well developed even when the spot is completely missing.

Despite the fact that *napi* were three times introduced from outside into the stock "III" during the first six generations (not counting the parental crossing), no particular diminution of the *bryoniæ* pattern could be noticed. On the contrary the homozygous *BB* individuals which appeared first in the 10th generation were obviously darker and had broader vein markings than the mother. This is also proof that the mother was, in spite of her high-alpine origin, heterozygous.

In spite of the well-proven monohybrid inheritance of the *bryoniæ*-*napi* pattern one could hardly explain the extreme range of variability of *bryoniæ* by only a twofold nature of its genotype. Moreover, the same phenotype can be either homozygous or heterozygous; crosses of *napi* with heavily dark *bryoniæ* females give rise to hybrids which do not differ from specimens usually considered as normal *bryoniæ* (brood 3/III-3), while on the other hand several stocks of homozygous *BB* individuals bred from heterozygous parents show a less pronounced *bryoniæ* pattern than the just mentioned primary hybrids. In respect to the clear monohybrid segregation there can be little doubt that this very variable shading of the *bryoniæ* pattern depends on polygenic factors independent of the *B* gene. This is most clearly shown by the observation that among the progeny of the two similarly heterozygous *bryoniæ* sisters but with different *napi* fathers (back-crosses), both phenotypes

bryoniæ and *napi* may be considerably different in the dark shading, depending on the intensity of the dark pattern of the *napi* father mated to the *bryoniæ* mother (brood 278). If the *napi* father has a dark pattern, the entire progeny which segregates into *bryoniæ* and *napi,* will have a dark one, too. Similarly a paler *napi* father gives rise to brighter individuals of both forms, *bryoniæ* and *napi* (Fig. 3). Although the shading varies in both crosses, the *bryoniæ* pattern is preserved, since even in the palest females the bryo-streak is fully developed. Such pale females can always be reliably distinguished from every *napi* individual. One can compare the differences described to more or less exposed or developed copies made from the same photograph negative.

Thus, the intensity of this *bryoniæ* character depends not only on the *B* gene itself but also on the genes which control the appearence of melanin in general. Apparently we have here an analogy to the expression of the dark markings in the Nun Moth, *Lymantria monacha,* as it was postulated by GOLDSCHMIDT (1921, 1928).

Apart from such multiple chromogene genes there are also other genes which control the extent of the dark suffusion along the veins. It is well known that this suffusion varies from very narrow lines, hardly broader than the veins themselves, to such an extent that the dusky suffusion of two neighboring veins joins together and the whole surface of the wings becomes dusted with dark scales. A good support for the opinion that this suffusion depends on separate genes has been obtained in a cross between a heterozygous ♂ *bryoniæ* × *napi* and a ♀ *Pieris ergane* female, reared in 1935. The dark pattern of *P. ergane* is identical to that of *P. napi* or *P. rapæ;* but similarly to *P. manni* the spots have less-defined contours and the outer part of the forewings is often largely dusted with dark scales. In the female hybrids (*bryoniæ* × *napi*) ♂ × *ergane* ♀ the dark markings along the veins are strikingly broader on both the forewings and the hindwings than was the case in the father's (*bryoniæ* × *napi*) sisters, that show the width of the suffusion usual for *bryoniæ* × *napi* hybrids.

Consequently, the expression of the dark melanic pattern in *bryoniæ* would be dependent upon three independent groups of alleles: 1) the dominant allede *B* controls the extension of melanin along the veins, and its recessive allele *b* causes the absence of melanin; 2) an unknown number of additively acting genes (*M, m*) control the intensity of the darkening; whereas 3) a probably low number of genes would be responsible for the width of the vein-marking.

Now, after having got acquainted with all the possible genes influencing the dark pattern of *bryoniæ* females, we again must turn to the question of the dominance of the gene *B*. BOWDEN (1956) was right

in his doubt about the dominance of this gene so far as some mixed lowland *bryoniæ* - *napi* populations are concerned. Instead of a clear-cut distinction between the presence and absence of the bryo-streak, as was found to be the rule in our experiments, here its variability produces all transitions ranging from a common dark streak to a few scarcely visible dark scales or perhaps none. The same seems to apply also to the dark vein markings, which can be as narrow as in some more strongly marked *napi* specimens of pure *napi* populations. In such cases one cannot decide whether such a transitional specimen carries only two *b* genes or also a *B* gene. In my last crossing experiments no such specimens were available, and the crossings carried out many years ago were not complete. However, by a more thorough genetical investigation of this character perhaps very interesting detections could be done. Apparently, two possible explanations may be taken into consideration: either there exist two or even more multiple *B* genes with different manifestation of the bryo-streak, or the recessive gene *b* of these populations is not identical with the gene *b* of the pure *napi* populations, bringing about a stronger vein suffusion than commonly found in *napi,* so that sometimes a slight bryo-streak appears too. Such a supposition could lead to the conception that the gene *b* in *bryoniæ* populations is not derived from hybridization with *napi* populations, but that it takes part in the specific gene pool of *Pieris bryoniæ* as a distinct entity. The confirmation of such a supposition might turn our opinion in favour of the conviction of those authors who consider *bryoniæ* as a separate species. However, in the absence of experimental evidence for any of these hypotheses we must for the present emphasize the genetic proof that the *napi* pattern segregates from heterozygous *bryoniæ.*

Finally, it should be remembered that the intensity of the melanic color depends also upon environmental factors, especially on temperature and humidity. It is known that low temperature and high humidity lead in Pieridæ to spread of melanin, so that it is more than probable that the form "concolor" Röb. is at least partially due to these environmental influences. Pupæ kept in the refrigerator at the time of development gave imagos with extremly wide vein suffusion, while conversely, heat and dryness gave rise to pale and bright individuals.

Everything said so far applies only to the female sex. We must, however, also take into consideration the male sex, although it is not so important for our purposes, since here the phenotypic differences of the genes in question are only slight. Careless observers or novices mostly think that there are no differences between the males of *bryoniæ* and *napi,* which may be true only exceptionally for the spring brood. In the

summer broods *bryoniæ* males are distinguished by gray streaks along the veins on the upperside, particularly on the hindwings, where these markings gradually diminish from the margin of the wing to half way toward the discocellular vein. Rarely the darkening is of such a width that the neighboring markings join near to the wing margin. Usually the markings are developed only as narrow "vein-streaks" as shown in fig. 1, left. In *napi* these gray vein-streaks are either absent or are present as minute dark triangles at the ends of the veins (fig.1, right). In the spring brood the triangles can be prolonged about one millimeter or two at most; this is the only case when males of *bryoniæ* cannot be distinguished with certainty from the *napi* ones.

The vein-streaks are present in every *bryoniæ* male which carries at least one *B* gene, *i. e.* not only in homozygous but in heterozygous individuals too. This circumstance is of great value in the establishment of more precise ratios of phenotypes in segregation, because it is possible to determine the presence or absence of the gene *B* in almost every brood in males as well as females, so that the numbers usable in determining ratios are twice as large. The phenotypic differences of this character correspond in almost every case very well to the expected ratios of 3 : 1 or 1 : 1 (see Tables 1 and 3).

Of course, the stronger vein darking in *bryoniæ* males is present in the forewings as well as the hindwings, although in these the difference from *napi* is not so apparent, because the apical spot always sends shorter or longer vein-streaks towards the inside of the wing.

The demonstration that gene *B*, which controls the dark pattern of *bryoniæ*, is dominant over the recessive *napi* gene, so that pure *napi* traits segregate from heterozygous *bryoniæ*, is of decisive significance. It reveals that *napi* must be always homozygous recessive, *bb*, while phenotypic *bryoniæ* can be either homozygous, *BB*, or heterozygous, *Bb* (Table 2). MULLER and KAUTZ (1938) considered specimens with *bryoniæ* pattern as pure *bryoniæ* or as its ssp. *flavescens* because they did not know this. They also did not know or underestimated the fact that from heterozygous *bryoniæ*, although very dark, specimens of the *napi* phenotype segregate which do not differ from individuals of a pure *napi* population. MULLER even quoted from the literature some cases of the appearence of *napi* specimens within *bryoniæ* broods, but he explained them as individuals accidentaly introduced with the food (*l.c.*: pp.36, 37). Corresponding examples in their monograph are: Tab.6, fig.15; tab.5, fig.11; but also 6, 7, and 8, except for their yellow color. It is true that MULLER and KAUTZ count such *napi* individuals as *bryoniæ* ssp. *flavescens* Wagner, but there is no proof whether they belong to this subspecies or

rather are descendants of a cross with *napi*. It is only certain that such *napi* individuals belong to the *population* of Mödling, which is composed of both *flavescens* and *napi*. Whether they belong to *napi* or *flavescens* cannot be resolved without breedings or crossings, as will be shown below. We shall learn also that *bryoniæ* × *napi* heterozygotes are sometimes present but concealed by the dominance of the gene *B* even in the so called "pure" mountain *bryoniæ* populations.

THE *Y y* ALLELES. It was mentioned above that the factor for the brownish-yellow ground color of the *bryoniæ* females is dominant, although it is not sure that it is really so, since this color shows graduated intensity in both the crossings and in nature. Owing to its strong sex-controlled manifestation it is not easy to decide whether this character depends upon one or more pairs of alleles. Since the males are entirely white, without any trace of a yellowish color, the choice of males in crossings is entirely by chance when pure stocks are not at one's disposal.

The back-cross (R × P - 1932) between an intense yellow *bryoniæ Bb* female from Rogovilec (see below) and a pure *napi* male from Zagreb, where no yellow specimens occurred, seem to be a rather decisive one: 28 yellow and 30 white females appeared, the yellow specimens being represented by all transitions from nearly the same yellow color as the mother had to the very pale one; all white females had the same white color. This cross indicates that the gene for the yellow color is likely to be incompletely dominant, *Y*, its expression being variable, and that there is no more than one allelic pair for this color, a rather unexpected result, since such a gradual color variability usually is attributed to polygeny. However, the characters which are dependent on the cumulative action of polygeny can by no means result in a ratio of 1 : 1, providing, of course, that the estimation of color was correct.

The genetics of this character thus seems to remain somewhat obscure, too.

THE *W, w* PAIR. Especially interesting is the allele W which controls the white color of the underside of the hindwings and the apex of the forewings in the males of *bryoniæ* populations. It is completely dominant over the greenish-yellow color of the recessive gene *w*. The same applies to the female sex, although the gene *w* is manifested only exceptional by the white color, mostly by a pale buff one. The phenotypic manifestation of the recessive allele, *w*, is always the same in males and in females, in *bryoniæ* and in *napi*. *W* is a remarkable gene in that male sex-controlled polymorphism is very rare in Lepidoptera, as pointed out by REMINGTON

Table 4. $Ww \times ww$. Expected 1 : 1 ratio.

Brood	W ♂ : w ♂	W ♀ : w ♀	W ♂♀ : w ♂♀	χ^2	P in %
1 bn	13 : 12	17 : 17	30 : 29	0.0169	>80, <90
5 bn	2 : 3	2 : 4	4 : 7	0.8182	>30, <50
4 b	7 : 7	11 : 6	18 : 13	8.8064	>30, <50
4/4b	4 : 0	3 : 5	7 : 5	0.3333	>50, <70
2 b	6 : 6	3 : 3	9 : 9	0.0000	100
24b	13 : 2	5 : 5	18 : 7	4.8400	>2, <5
14-2/4b	2 : 10	2 : 1	4 : 11	3.2666	>5, <10
1 bbn	4 : 0	1 : 1	5 : 1	2.6666	>10, <20
3 bbn	4 : 5	2 : 3	6 : 8	0.2857	>50, <70
6/4b	3 : 0	2 : 3	5 : 3	0.5000	>30, <50
5(27)	5 : 5	— —	5 : 5	0.0000	100
5_2	9 : 9	9 : 10	18 : 19	0.0270	>80, <90
85	0 : 3	4 : 3	4 : 6	0.4000	>50, <70
60	2 : 1	2 : 0	4 : 1	0.9000	>10, <20
Total	74 : 63	63 : 61	137 : 124	0.6475	>30, <50

(1954). Although we do not deal here with a quite true sex-controlled dimorphism, since the difference appears in both sexes, the dimorphism is much more pronounced in the males than in the females, the latter being sometimes difficult to distinguish in respect to it.

It is worth nothing that the genetical identity of the white males and pale buff females has not been realized before the present analysis. Each of these two forms has been proviously considered to be a separate variant: ab. ♂ "subtalba" Schima and ab. ♀ "subtochracea" Kautz. MULLER and KAUTZ reported that "subtalba" can also rarely be found in males and females of *napi,* and they quote the find of a "subtalba" female in Pommerania in northern Germany. It is obvious that the white color of this female has nothing to do with the gene *W*, as was already suspected by MULLER (1938).

Another interesting point of this gene pair is that the author has not as yet been able to obtain a brood homozygous for the gene *W*. As is shown in Table 4, the segregation is the rule and the ratio 1 : 1 prevails. Of the two 3 : 1 ratios, broods 2/4b and 1/bbn, the first is only apparently of this kind since the brood was raised from a back-cross, the mother of the second brood unfortunately escaped before her phenotype was noted. It is striking that 8 of 11 matings between *Ww* individuals were entirely sterile, whereas 3 others gave a total of only 5 individuals, 3 of them in one brood. Only the back-crosses were successful, and even

among these a great part produced no progeny. The writer is inclined to attribute this failure to inbreeding rather than to any other essential cause, except the F_1 hybrid sterility, which will be discussed below.

No population of *bryoniæ* is known in which the gene *W* is the exclusive allele. One of the most significant concentrations of this gene so far known to me occurs in the Julian Alps, where about 45% of all phenotypes are *W* bearers. According to PETER's (1950) count the proportion of the "subtalba" males in the Allgäuer Alps is 19%. No white males had been recorded in the western Alps, as some authors have claimed.

RECOMBINATION IN REARED POPULATIONS. The three gene pairs controlling the morphological features of *bryoniæ* and *napi*, already discussed above, have been found to segregate and completely recombine in the F_2 generation and back-crosses. The dihybrid back-cross "R × P - 1932" already mentioned is especially illustrative. It yielded four female phenotypes: *bryoniæ* pattern and yellow color (*Bb Yy*), *bryoniæ* pattern and white color (*Bb yy*), *napi* pattern and yellow color (*bb Yy*), and *napi* pattern and white color (*bbyy*) in the ratio 14 : 14 : 16 : 14, which agrees very well with the expected dihybrid ratio 1 : 1 : 1 : 1. Besides these two gene groups free combinations with the *Ww* alleles have also been obtained, among them the formerly scantily-known combinations *bYW* and *byW*. Thus the three pairs of alleles are located in different chromosomes, all autosomes. This is only to be expected where the number of chromosomes is so large ($n = 25$). The recombinations are the same as certain "varieties" or "aberrations" from natural collections, already described, and it seems likely that the genetical explanation of these natural variants has therefore been found. I shall mention some examples of such natural "aberrations": *bryoniæ* "obscura albida" (*BB yy*), *bryoniæ* "albida" Müll. (*Bbyy*), *bryoniæ* "flavida reducta" Müll. (*bbYY* or *bbYy*), and *bryoniæ* "albida reducta" Müll. (*bb yy*). This shows at best how unsound it may be to give names to forms which are no more than recombinations of a few gene pairs.

However, before starting with the comparison of the experimental genetic results and the circumstances in nature we must briefly get acquainted with the other morphological as well as physiological and ecological differences between *bryoniæ* and *napi*.

(To be continued)

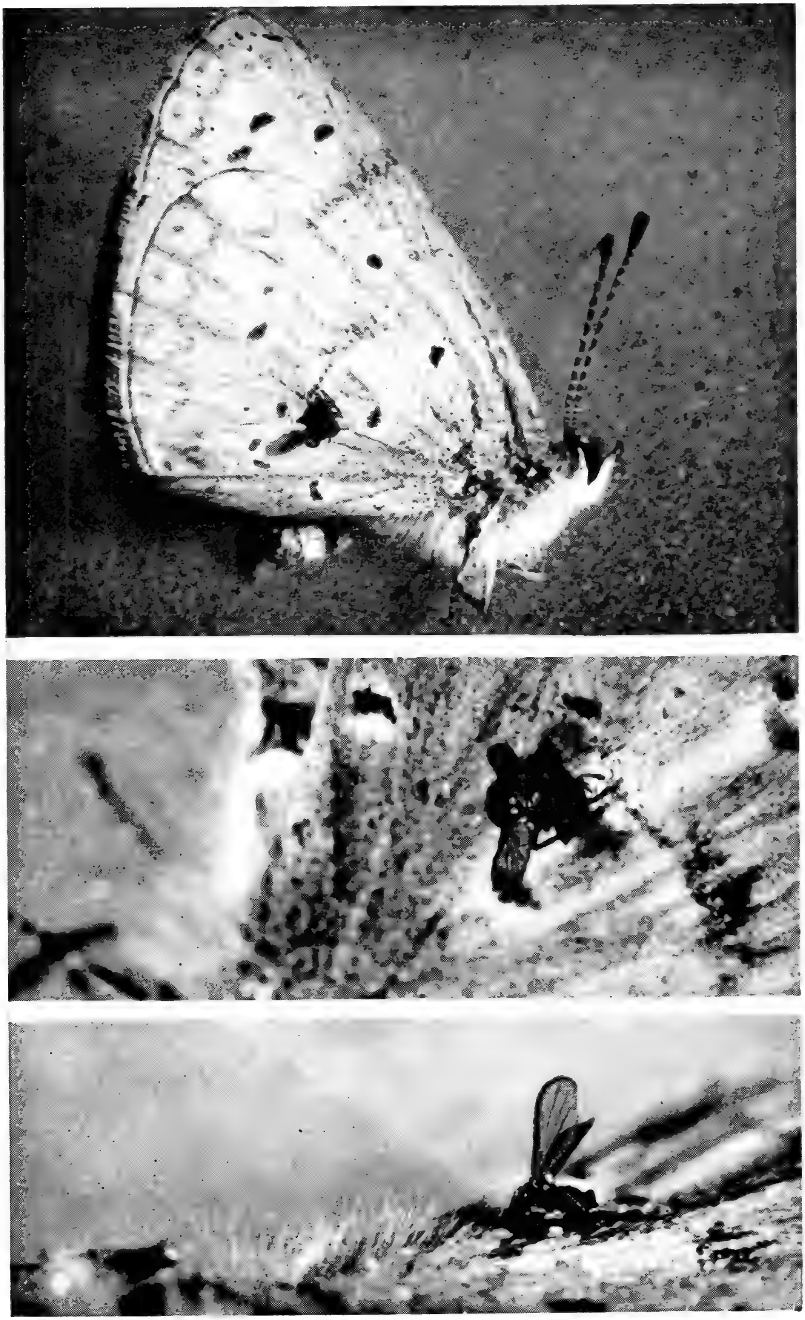
A BITING MIDGE ECTOPARASITIC ON ARIZONA LYCÆNIDS

by Paul R. Ehrlich

On 21 August 1961, I was using a Questar telescope to observe individuals of *Celastrina argiolus* (=*Lycænopsis pseudargiolus*) sucking moisture from damp spots in the road running through the South Fork of Cave Creek (Chiricahua Mts., Cochise Co., Arizona, 5200 feet). Two small flies were seen to alight on the ventral surface of the hindwing of an individual under observation, and when the butterfly was carefully collected with forceps one stayed in place, while the other flew off. The fly remained attached while the butterfly was killed in a cyanide jar, and it was therefore possible to obtain the accompanying photographs of the parasite *in situ*.

Dr. W. W. Wirth, of the U. S. Department of Agriculture, has identified the fly as *Forcipomyia* (*Neoforcipomyia*) *baueri* Wirth, a member of the dipterous family Ceratopogonidæ (=Heleidæ) which is well known to most of us through the activities of the members which attack man (known variously as punkies, no-see-ums, sand flies, all-jaws, etc.). *Forcipomyia baueri* was described from a series of specimens taken by D. L. Bauer from the underside of the wings of *Callophrys* (*Mitoura*) *siva* and *Philotes enoptes* on Mingus Mountain, Yavapai Co., Arizona. The only other record which has come to my attention of a *Forcipomyia* attacking a North American butterfly is that of *F. mexicana* Wirth attacking *Pyrrhogyra otolais* Bates (Nymphalidæ: Nymphalinæ) in Mexico (collected by Bauer). Wirth's (1956) excellent paper on biting midges ectoparasitic on insects shows exotic ceratopogonids to be quite catholic in their tastes, with attacks recorded on *Pieris* (Pieridæ, Pierinæ), *Eurema* (Pieridæ, Coliadinæ), *Danaus* (Nymphalidæ, Danainæ), *Morpho* (Nymphalidæ, Morphinæ) and *Helicopis* (Lycænidæ, Riodininæ).

Ceratopogonids also attack larval butterflies, adult and larval moths, and a wide variety of other insects. In all cases they are presumably "bloodsuckers" (ingest the hæmolymph). Many aspects of the relationship between the ectoparasitic midges and lepidopterans deserve study; it would be especially interesting to know the degree of host specificity displayed by the midges. Lepidopterists are urged to make detailed observations on any observed attacks, and to submit the flies to Dr. Wirth for identification.



Top: *Forcipomyia baueri* on ventral surface of right hindwing of *Celastrina argiolus*. Middle and bottom: close-up views of the midge. [Photos by M. A. Mortenson.]

I would like to thank Dr. W. W. Wirth for identifying the midge, and Mr. Martin A. Mortenson for taking the photographs. This work was done while the author was at the Southwestern Research Station of The American Museum of Natural History, and was supported by Grant No. G-14740 from the National Science Foundation.

Reference

Wirth, Willis W., 1956. New species and records of biting midges ectoparasitic on insects (Diptera, Heleidæ). *Ann. ent. soc. Amer.* 49: 356-364.

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GUIA PARA EL ENTOMOLOGO PRINCIPIANTE. [Guide for the beginning entomologist; in Spanish.] By Kenneth J. Hayward. 1961. 168 pp., 7 pls. Instituto Miguel Lillo, Universidad Nacional de Tucuman. Argentina, *Miscelanea,* No. 22. Available from the Instituto for $3.00 USA.

This is a manual of entomological procedure aimed at beginners in the study of insects. These are discussions of the morphology and classification, of collecting techniques, and of the orders of insects. Professor Hayward recognizes 34 orders. This is a larger number than seems ideal in the light of recent work, and especially good grounds exist for reducing to infra-ordinal status his Phasmida, Diploglossata, Megaloptera, and Raphidiodea. Probably the Isoptera should stand next to the Blattaria, and in the Apterygota the Collembola should be listed first (or better eliminated from the Insecta), Protura second, Entotrophi third, and Thysanura last; Thysanura are by far the closest to the Pterygota, and Collembola and Protura by far the most remote. But these old classificatory points are common to many current general texts, and the work under review cannot be singled out for them. Spanish-speaking insect collectors needing a beginner's guide will find this work valuable.

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ECOLOGICAL STUDIES OF RHOPALOCERA IN A HIGH SIERRAN COMMUNITY – DONNER PASS, CALIFORNIA. I. BUTTERFLY ASSOCIATIONS AND DISTRIBUTIONAL FACTORS

by THOMAS C. EMMEL and JOHN F. EMMEL

The State of California, extending some 1,264 miles along the Pacific Coast of North America, contains 158,693 square miles of dry deserts, moist coastlands, chaparral-covered hills, and great mountain ranges, with unparalleled opportunities for the ecologist and lepidopterist alike. Practically every combination of climatic factors may be found within the state's boundaries. Six life zones, with approximately 4000 species of fern-allies and flowering plants, lie at elevations ranging from 282 feet below sea level to 14,495 feet at the peak of Mount Whitney. Temperatures and rainfall correspond generally with these life zones; average annual rainfall ranges from about 0 inches to 70 inches, and mean temperatures of about 40°F. in boreal regions to high summer temperatures of 130° in the deserts are recorded. Thus California provides many unique locations to study the ecological aspects of a species' adaptation and preference for a particular environment.

One such location – the Donner Pass area in the Sierra Nevada, Placer County, California – was selected for intensive study during the summers of 1956 and 1960. This location encompasses the flora of three life zones and ranges in elevation from 6800 to 8300 feet. This paper reports the general ecological observations made on each of the 76 recorded species, forms and races of Rhopalocera and the four habitats selected for study in the area. Factors involved in butterfly distribution are discussed using examples from this Donner Pass study and the literature.

INTRODUCTION

In this Donner Pass study and past investigations by other authors, two general factors in the ecology of Rhopalocera have been emphasized:

(1) Preference of many species for a particular type of habitat.
(2) Effect of weather (extrinsic environmental conditions) on butterfly flight periods.

A second paper will treat the latter subject. The present paper reports our data on the general ecology of the Donner Pass butterfly fauna.

E. B. FORD (1957), in considering the geographical distributions and ecological preferences of British butterflies, notes that it is often difficult to separate these two distinctions. Many species will normally occur within a particular region and this region, though usually composed of varying habitats, is known as part of the general geographic distribution of each resident or migratory species. However, within that general region, the ecological preferences of each species dictate the distribution of that butterfly.

As yet, few published papers have been devoted entirely to the ecology of butterflies in a particular locality. TILDEN (1959) has done comprehensive studies on the butterfly fauna of Tioga Pass, California. He arranges the 43 species in groups based on their apparent abundance in various sub-alpine and alpine plant associations. Certain habits of alpine butterflies are noted. TILDEN concludes that range is usually determined by the presence of food plants, although food plants of some of these alpine species are presently unknown. In this author's estimation, the occurrence of the adult butterflies is less effected by particular environmental conditions than is that of the plants.

Many authors have noted habitat preferences for single species or groups of Rhopalocera. MUNROE (1951) in reporting collecting conditions in northern Quebec observed a seasonal succession and an altitudinal zonation of the various resident species. The flight season was so short that the time of appearance of species differed in days instead of weeks "as in more temperate climates." Different *Boloria* and *Plebeius* species each had specific habitats, such as "rocky hilltops" and "only on grassy beds of dried-up lakes at from 2200 to 2400 feet." EHRLICH (1954; 1956) treats the *Erebia* in northwestern America from an ecological standpoint. BROWN, EFF and ROTGER discuss the ecological preferences of over 200 species in their book *Colorado Butterflies* (1957). BROWN (1952) also discusses the restricted ecological preferences of *Oeneis oslari* Skinner in the South Park area of Colorado; the type of soil and terrain preferred is apparently directly related to the presence of the food-plant grass.

As in BROWN's paper (1952), many authors have attempted to give possible explanations for the basis of these "ecological preferences" of a species. Probably the most acceptable explanation for limiting factors in the distribution of resident species is the presence of food plants. The "hilltop" controversy of a few years ago brought out possible reasons for congregations of butterflies. SHOUMATOFF (1953) summarizes past authors' hypotheses into two groups: ecological explanations, such as food-plant search, wind, and tropism, and intrinsic factors, such as "liking hilltops," "social ambition," and "gregariousness." ARNHOLD (1952)

notes that *Euchloe olympia* prefers to fly along the leeward side of ridges (near Dresbach, Minnesota); a narrow band of calm is created on the top or side of the banks according to wind direction. Thus wind, as well as food plant, appears to definitely be a factor in the local habitat preference of a species.

Since a species generally is very restricted to one group or species of food plant, it follows that the geographic range of the butterfly will correspond to the range of the required plants. However, climatic factors within the range may prevent the butterfly from existing with its food plant. Since butterflies are poikilothermic ("cold-blooded") and therefore dependent on solar heat for their activity, species cannot live where temperature and solar radiation do not meet their tolerances (Hovanitz, 1958).

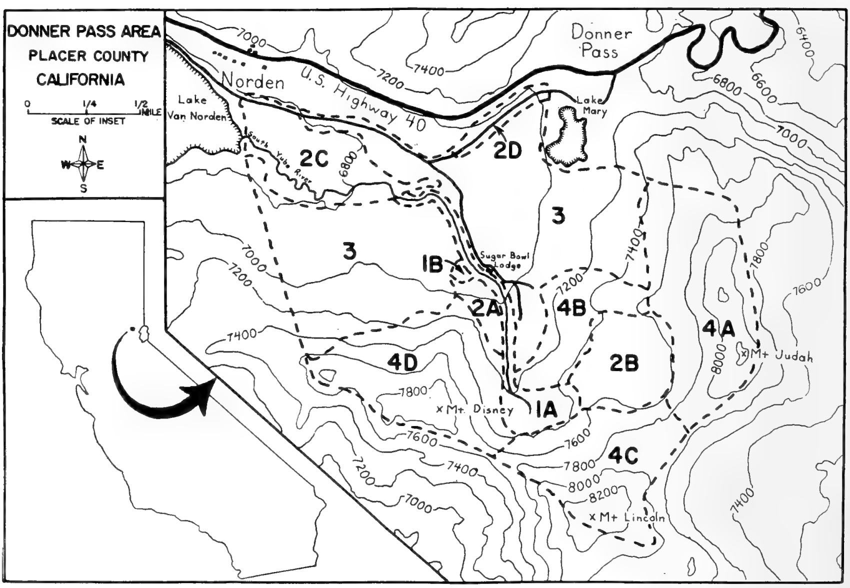
Ehrlich (1956) lists climatic factors that could limit *Erebia* distribution in habitats of northwestern America, such as temperature fluctuations, amount of cold, snow cover, rapidity of runoff, and amount of spring flooding of habitat. The influence of any of these factors on butterfly distribution over a large territory would be the subject of a very interesting paper, but that would require an intensive investigation over many years.

The contribution of this paper towards studies of the latter type is to report information on the local habitat preferences of butterflies in a single locality. Perhaps some day we will have enough information to provide a generalized survey of climatic and vegetational factors, and their influence on butterfly distribution, for the entire Sierra Nevada range. However, towards the end of this paper, we have discussed the apparent reasons for habitat preference in the Donner Pass Rhopalocera, and these conclusions may prove to be a step on the way to full understanding of the factors involved in butterfly distribution.

Habitats of the Donner Pass Area

The Donner Pass area is located on the crest of the Sierra Nevada range at an elevation of 6800 to 8383 feet, 15 miles northwest of Lake Tahoe, in Placer County, California. Flora and fauna of both the east and west slopes of the Sierra meet along this crest. Adding to the desirability of the study area is the union of three life zones here — Transition, Canadian, and Hudsonian — with Canadian zone vegetation comprising most of the territory. Four habitats within the Donner Pass area were studied: wet meadow, dry meadow, forest, and montane.

Fig. 1. The Donner Pass area, looking N.N.E. from Mt. Disney (7,953′). In center of photograph is Sugar Bowl Lodge, with the dry and wet portions of the Lodge meadow at lower center and at left. Lake Mary is at upper center; long railroad snowsheds and Highway 40 are at upper left. The actual Pass is slightly to the left of upper center.



Sketch map of the State of California showing the locality studied, and topographical map (inset) of the Donner Pass area showing the habitats (numbered 1A through 4D) described in the text. Primarily from Geological Survey map, Norden Quadrangle, California, 7.5 Minute Series, U. S. Dept. of the Interior (1955).

1. Wet Meadow

A. Sugar Bowl and South Yuba River

The Sugar Bowl is a small bowl-shaped valley (elevation 7260 feet) formed by the confrontation of Mt. Disney, Mt. Lincoln, and the high ridge connecting the two peaks. A heavy snow pack on these slopes, coupled with scattered springs, provides a considerable flow of water into this area. Here also is the source of the South Yuba River, which flows into Lake Van Norden. Thus there is an abundance of plants due to the moisture and rich soil. Willows (*Salix*) are found in scattered thickets in the Sugar Bowl and along most of the length of the river. Grasses (*Poa* species) and sedges (*Carex*) are common throughout the area. Other common plants are Cow Parsnip (*Heracleum lanatum*), Sierra Sweet Cicely (*Osmorrhiza occidentalis*), Scarlet Gilia (*Gilia aggregata*), Common Monkey Flower (*Mimulus guttatus*), and Elephant Heads (*Pedicularis grœnlandica*).

B. Wet Portion of Lodge Meadow

This area (elevation 7000 feet) is located at the base of Mt. Disney, where numerous springs provide a very wet environment. About one-half of it is covered with willows. In the other portions one finds a large number of grasses and flowers. Some of the more common plants are Indian Paint Brush (*Castilleia miniata*), Common Monkey Flower (*Mimulus guttatus*), Columbine (*Aquilegia truncata*), Larkspur (*Delphinium pauciflorum*), Tiger Lily (*Lilium pardalinum*), and Meadow Rue (*Thalictrum fendleri*).

2. Dry Meadow

A. Lodge Meadow and Adjacent Portions

This flat area near the Sugar Bowl Lodge supports many flowering plants despite its dryness in July and August. Fireweed (*Epilobium angustifolium*), Common Yarrow (*Achillea millefolium*), and Pussy Paws (*Calyptridium umbellatum*) are common. Elevation: 6960 to 7000 feet.

B. Emigrant Meadow

Emigrant Meadow (elevation 7500 to 7600 feet) is a dry flat expanse with few plants; two species are Yellow-bud Penstemon (*Penstemon lætus*) and *Saxifraga æstivalis*.

C. Summit Valley

Summit Valley (elevation 6800 feet) is a large flat meadow which is marshy in the spring, but dry throughout July and August. Grasses dominate most of the area but in some places Pussy Paws, Yarrow, and Pepper Grass (*Lepidium perfoliatum*) can be found.

3. Forest

Dense forest covers about one-half of the total study area, particularly between 6800- and 7600-foot elevations. This is almost all Canadian zone forest. Some of the forest trees and plants near Lake Mary and Lake Van Norden are typical Transition zone inhabitants, and the higher montane forest is typical of the lower Hudsonian zone. The majority of the forest trees are Red Fir (*Abies magnifica*), Lodgepole Pine (*Pinus contorta*), Silver Pine (*Pinus monticola*), and Mountain Hemlock (*Tsuga mertensiana*).

On the forest floor a great variety of plants are found. Collecting was usually good in small clearings or near the forest edge; many butterfly species were found beneath an aerial transportation system (used in winter), which cuts a swath through the forest from Highway 40 to Sugar Bowl Lodge. Some of the forest plants are the Spotted Coral Root Orchid (*Corallorrhiza maculata*), Fireweed, Corn Lily (*Veratrum californicum*), Yarrow, Pine Drops (*Pterospora andromedea*), and Alpine Shooting Star (*Dodecatheon alpinum*).

4. Montane

A. Mount Judah

Mount Judah (8,243′) appears barren due to the large granite boulders scattered over its talus slopes. The dry, almost soilless environment discourages most trees. The flora includes Alum Root (*Heuchera micrantha*), Rabbit Brush (*Chrysothamnus nauseosus*), Sage Brush (*Artemisia tridentata*), and Mule-Ears (*Wyethia mollis*).

B. Rocky Slope leading to Mount Judah

Seemingly a jumble of small granite rocks, this area (elevation 7160 to 7400 feet) supports many plants; included in this flora are scattered Lodgepole Pines (*P. contorta*), *Wyethia mollis*, *Lupinus*, and *Sedum* species.

C. Mount Lincoln

Mount Lincoln (8,383′) is quite similar to Mount Judah. One minor difference is the presence of Mountain Hemlock (*Tsuga mertensiana*).

D. Mount Disney and Crow's Nest

This twin-peaked mountain is part of a long ridge and supports a flora similar to the other peaks, although Mt. Disney (7,953′) has more species. Found here are Red Fir, Lobb's Buckwheat (*Eriogonum lobbii*), Mountain Alder (*Alnus tenuifolia*), *Chrysopsis brewerii*, and Western Pennyroyal (*Monardella odoratissima*).

Local Distribution and Ecological Preferences of Species Recorded

The phrase "flight period" refers herein to the first and last records for the species. Observations were made from June 17 to August 26 (1960, unless otherwise noted); obviously, some species were already flying before the first day of observation. Nomenclature of species follows Ehrlich (1961a). Subspecific names are used for clarity with certain polymorphic western species, such as in *Speyeria*.

A. PAPILIONIDÆ

1. *Papilio zelicaon* Luc. Flight period: June 17-August 6. Uncommon; males found typically on peaks of area (bare rocks) and never observed visiting flowers. Females on lower slopes of Mt. Judah, flying around food plant (*Cymopterus terebinthinus*) and ovipositing single eggs (observed fresh female depositing eggs, around 10 a.m. on June 27); one female seen visiting Western Pennyroyal (*Monardella odoratissima*).

2. *Papilio indra indra* Reak. Flight period: June 17-July 10. Males occasionally seen around 3 peaks of area and lower slopes of Mt. Judah (landed on rocks and opened wings to "sun" themselves). Males frequently seen at muddy places. Females occasionally (June 27, June 30) seen ovipositing single eggs on *Cymopterus terebinthinus*. L. M. Martin has found several hundred *indra* larvæ on this *Cymopterus* at Kaiser Peak (10,000′), Fresno Co., Calif.

3. *Papilio rutulus* Luc. Flight period: June 17 - July 15. Males occasionally seen around willows and in forest; one female observed laying eggs on willow in Summit Valley.

4. *Papilio eurymedon* Luc. Flight period: June 17 - July 24. Males common in wooded areas; females on lower slopes of Mt. Judah.

Reported food plants available: *Ceanothus velutinus* and *prostratus*, and *Prunus emarginata*.

5. *Parnassius clodius baldur* Edw. Flight period: June 27-July 25. Found almost everywhere, but particularly abundant on the lower slopes of Mt. Judah (females laying eggs on or near *Sedum* in this location).

B. PIERIDÆ

1. *Neophasia menapia* F. & F. Flight period: August 8-August 15. Only on lower slopes of Mt. Judah and Lake Van Norden area; males flying around upper tips of *Pinus contorta;* no females seen.

2. *Pieris sisymbrii* Bdv. Flight period: June 20 - June 28. Lower slopes of Mt. Judah, but only seven adults observed during summer (1960). Species of Cruciferæ (recorded food plants) present in area.

3. *Pieris protodice* L. Flight period: June 23 - August 25. Most common in dry meadows; known food plants (Cruciferæ), such as mustard species, were present; double-brooded.

4. *Pieris rapæ* L. Flight period: June 18 - August 14. Dry and wet meadows; reported food plants (Cruciferæ) abundant.

5. *Euchloe creusa hyantis* Edw. Flight period: June 21 - July 13. Only on lower slopes of Mt. Judah; food plants (Cruciferæ) present.

6. *Anthocaris sara* form *julia* Edw. Flight period: June 18 - July 16. Lower slopes of Mt. Judah and open wooded slopes; rarely seen in meadows. Food plants (mustard species) present; several mature larvæ found in mid-June (1956). Males identical to typical white *reakirtii* were occasionally taken in fresh condition. *A. julia* is a yellow- tinted, high-altitude form of *sara,* while the lowland, spring form of *sara* is *reakirtii.*

7. *Colias eurytheme* Bdv. Flight period: June 17 - August 26. Found in all habitats, but most abundant in Summit Valley meadows. Females seen ovipositing on clover (*Trifolium*).

8. *Colias eurytheme* form *amphidusa* Bdv. Flight period: July 1 - August 26. Appeared in early July and by August this strongly-marked form was dominant over typical *eurytheme.*

9. *Colias philodice eriphyle* Edw. Flight period: (July 1). Only 3 found — in dry meadows of Summit Valley.

C. DANAIDÆ

1. *Danaus plexippus* L. Flight period: June 23 - August 25. No milk-weed species in area and individuals seen were likely strays from lower elevations.

D. SATYRIDÆ

1. *Cœnonympha tullia californica* Westwood. Flight period: (late June). Seen only in 1956 (wet winter) in late June on Mt. Judah (grassy areas). Flight period in 1960 (dry winter) may have finished by June 17.

2. *Cercyonis sthenele oetus* Bdv. Flight period: July 11 - August 20. Found only on high western slope (above 8000 feet) and around peak of Mt. Judah; landing on sagebrush stems (*Artemisia tridentata*). Food plant likely to be grasses, which were abundant on mountain. Adults (both sexes) visited Western Pennyroyal blooms.

E. NYMPHALIDÆ

1. *Speyeria cybele leto* Behr. Flight period: July 15 - August 3. Five fresh specimens seen on lower slopes (6,980′) of Mt. Disney, visiting Western Pennyroyal flowers. Possible food plants (*Viola* species) for *leto* and the following *Speyeria* species were present in wet meadows.

2. *Speyeria zerene zerene* Bdv. Flight period: August 2 - August 25. Uncommon; both sexes visited Western Pennyroyal on lower slopes (6,980′) of Mt. Disney.

3. *Speyeria coronis snyderi* Skin. Flight period: July 3 - July 15. Females proportionately more common than males; flying around Western Pennyroyal on Mt. Disney (6,980′).

4. *Speyeria atlantis irene* Bdv. Flight period: July 12 - August 26. Both sexes almost as abundant as *S. mormonia arge;* adults visited Western Pennyroyal. Females occasionally seen in wooded areas.

5. *Speyeria mormonia arge* Stkr. Flight period: June 29 - August 26. The most abundant *Speyeria* and found throughout the Pass area; adults avidly visited Western Pennyroyal.

6. *Boloria epithore* Edw. Flight period: June 17 - July 22. Very abundant in forest and around Pine-mat Manzanita (*Arctostaphylos nevadensis*). Food plant is reported as *Viola* (violets).

7. *Chlosyne palla* Bdv. Flight period: (July 7). Only 1 worn male seen. Food plants (*Castilleia* and *Aster* species are reported) abundant in area. As *palla* is recorded from higher elevations than Donner Pass, some unknown climatic factor may prevent its establishment, or possibly the species has not extended its range to this particular area yet.

8. *Chlosyne hoffmanni hoffmanni* Behr. Flight period: June 25-August 6. Found throughout the area; very abundant where its food plant (*Chrysopsis breweri*) grows, especially on open slopes of Mt. Disney and Mt. Judah. Mature larvæ fairly common at end of June; females

laid egg masses, each containing 30 to 110 eggs. These eggs hatched in approximately 3 weeks, and larvæ grew quite slowly, staying together in communal webs. By last week in August, every larva observed had assumed a lethargic state. Larvæ were still in webs, though plants were dying.

9. *Phyciodes campestris montana* Behr. Flight period: June 18-August 25. Practically as abundant as *C. hoffmanni;* found most commonly where *Aster* species (recorded food) were growing in meadows. Females were observed hovering around *Aster integrifolius.*

10. *Phyciodes mylitta* Edw. Flight period: June 20-August 5. Scarce in area, although its reported food plant, thistle (*Cirsium*), was fairly abundant along Lake Mary road (dry location).

11. *Polygonia zephyrus* Edw. Flight period: June 20-August 18. Over-wintering individuals collected in late June and early July; fresh males collected in early August on *Monardella odoratissima.* Food plant (*Ribes viscosissimum* – Sticky Currant) common in Lodge meadow. Mature larvæ found by second week of July.

12. *Nymphalis californica* Bdv. Flight period: June 17-August 20. Over-wintering individuals numerous during late June. Swarms of larvæ found on *Ceanothus* in first two weeks of July on peak of Mt. Disney (lone location). About July 15, individuals began to hatch and on July 21, the species reached its peak of abundance with an estimated 5,000 seen in one hour in a 100′ x 100′ area on Mt. Judah. On this date, the butterflies began flying in a westerly direction at about 10 a.m. On July 22, population counts were about "normal" again.

13. *Nymphalis milberti* Godt. Flight period: June 17-August 6. Apparently a stray species in this area. Adults visited Western Pennyroyal. *Urtica,* the usual food for *milberti* and also *atalanta,* was not growing in the Pass area; it is abundant along streams at nearby, lower elevations.

14. *Nymphalis antiopa* L. Flight period: June 19-August 15. Over-wintering individuals seen during late June and early July. Fresh specimens seen during late July and early August. Food plant: willows.

15. *Vanessa cardui* L. Flight period: June 22-August 16. Seen around rocky peaks of the 3 mountains. Food plant: thistle.

16. *Vanessa atalanta* L. Flight period: June 22-July 21. Only several males seen, flying around peaks with *cardui.* No food plant in area.

17. *Vanessa virginiensis* Dru. Flight period: June 18-August 25. Also found around peaks with *cardui.* Larvæ were found during July on *Gnaphalium palustre* (Cudweed); this food plant grew only in one clump at the base of Mt. Disney.

18. *Vanessa carye* Hbn. Flight period: June 18-August 19. Found frequently throughout the area. Food plant probably *Lupinus* here.

19. *Precis lavinia* Cramer. Flight period: June 18-August 18. Males common in dry meadows; females common in wet meadows, and occasionally seen hovering over *Plantago* (*Mimulus* also in the area).

20. *Limenitis lorquini* Bdv. & Lec. Flight period: June 23-August 10. Frequently seen in willows (food plant) along the South Yuba River.

F. LYCÆNIDÆ

1. *Satyrium californica* Edw. Flight period: July 20-August 10. A distinct inhabitant of the area along the Lake Mary road. Adults flew around and landed on *Eriogonum nudum* blooms. Reported food plant is *Quercus;* Huckleberry Oak (*Quercus vaccinifolia*) was found in this area.

2. *Satyrium sylvinus* Bdv. Flight period: July 18-August 26. Found most commonly around willows (recorded food plant) on the lower slopes of Mt. Judah; adults landed on *Eriogonum nudum* flowers.

3. *Satyrium sæpium* Bdv. Flight period: July 20-August 16. Found only along Lake Mary road; females observed ovipositing on *Ceanothus velutinus.* Adults landed on *Eriogonum nudum* and Elderberry (*Sambucus velutina*).

4. *Satyrium behrii* Edw. Flight period: (August 4). One found in 1960; fairly abundant in 1956 on rocky slopes of Mt. Judah. Adults landed on *Eriogonum* blooms. Probable food plant: *Lupinus* species.

5. *Satyrium fuliginosa* Edw. Flight period: July 10-August 9. Fairly common on lower slopes of Mt. Judah. Females seen ovipositing on lupines (food plant).

6. *Strymon melinus* Hbn. Flight period: July 7-August 15. Found flying around *Eriogonum* blooms; fairly abundant. Reported food plant: *Polygonum alpinum* (Knotweed), present in several areas.

7. *Callophrys johnsoni* Skin. Flight period: (June 28). Probably a resident of the area, but extremely restricted colony. Female observed flying around *Arceuthobium* (a mistletoe and recorded food plant) on Mountain Hemlock at lower end of Sugar Bowl.

8. *Callophrys nelsoni* Bdv. Found rarely in 1956; foodplant (believed to be Incense Cedar – *Libocedrus*) not found in Pass area.

9. *Callophrys augustinus iroides* Bdv. Flight period: June 28 - July. Found rarely in late June and July on rocky slopes; adults fed on *Eriogonum.* Food plant: *Ceanothus* and *Sedum* reported by authors.

10. *Callophrys eryphon* Bdv. Flight period: June 28 - July 10. Only occasionally captured (on semi-forested, talus slope) but all fresh specimens. Food plant: probably *Pinus contorta.*

11. *Callophrys dumetorum perplexa* B. & Benj. Flight period: June 22-July 9. Occasionally found in the high montane areas (above 7,500′). Food plant probably an *Eriogonum* species.

12. *Lycæna arota virginiensis* Edw. Flight period: July 20-August 11. Found only along the Lake Mary road; fairly abundant. Males hatched in mid-July, females appeared in early August. Females were ovipositing on *Ribes montigenum* (Gooseberry) during first two weeks of August (eggs hatch the following spring).

13. *Lycæna editha* Mead. Flight period: July 15-August 19. Fairly common throughout the entire area, especially in dry meadows. A possible food plant (*Potentilla drummondii*) occurs in the Lodge meadow.

14. *Lycæna nivalis* Bdv. Flight period: July 3-August 17. Rather scarce; males more abundant than females. Found in dry meadows. Food plant is unknown.

15. *Lycæna cupreus* Edw. Flight period: June 17-July 15. Found in dry meadows. Adults frequently visited flowers of *Calyptridium umbellatum* (Pussy Paws). In early July, mature larvæ were found feeding on the blossoms of this plant; being pink in color, they blended well with the flowers.

16. *Lycæna heteronea* Bdv. Flight period: August 6-August 16. One small colony found near a tiny stream (elevation 7160′) on Mt. Judah. Observed food plant was *Eriogonum nudum*, and the adults frequently visited the flowers of this buckwheat.

17. *Everes comyntas amyntula* Bdv. Flight period: June 17-July 1. One colony found on the top of Mt. Judah (8,234′). Here the species' observed food plant, *Astragalus whitneyii* (Milkvetch or "locoweed") grew on top of the narrow ridge connecting the two peaks of Mt. Judah. A constant wind blew; both sexes landed on the plants and flew up only occasionally.

18. *Plebejus anna* Edw. Flight period: June 26-August 19. Found throughout the area but common only on the moist lower slope of Mt. Disney. Food plant unknown in spite of the species' abundance.

19. *Plebejus sæpiolus* Bdv. Flight period: June 19-August 17. Found only in wet portions of Lodge meadow and Summit Valley (very abundant). Females (all *rufescens* form) oviposited on *Trifolium hybridum* (Alsike Clover) throughout late June and July.

20. *Plebejus icarioides* Bdv. Flight period: June 22-August 3. Found throughout the area; especially common in areas with wide-spread patches of *Lupinus* (food plant)—usually on rocky talus slopes.

21. *Plebejus shasta* Edw. Flight period: June 30-August 18. Found throughout the area, and very common in dry meadows on mountain slopes. Some adults seen landing on *Monardella odoratissima* blooms. Food plant is unknown.

22. *Plebejus acmon* West. & Hew. Flight period: June 18-August 15. Found only in Lodge meadow in late June and along Lake Mary road in early August. Females oviposited on *Eriogonum nudum* (food plant).

23. *Plebejus acmon lupini* Bdv. Flight period: June 25-July 25. Found only in Sugar Bowl and on Mt. Judah. Food plant probably *Eriogonum*. Tilden (1959) suggests this insect may be a species distinct from *acmon*.

24. *Agriades glandon podarce* F. & F. Flight period: June 27-August 3. A small colony found in wet portion of Lodge meadow; fairly abundant here. Food plant perhaps *Vaccinium nivictum* (Sierra Bilberry), found in same area.

25. *Glaucopsyche lygdamus behrii* Edw. Flight period: June 17-July 16. Found throughout the area in late June, but most common on the moist lower slope of Mt. Disney. Food plant here probably *Lupinus*.

26. *Philotes enoptes* Bdv. Flight period: June 26-July 13. Males found landing on moist ground and flying on lower slopes of Mt. Judah. One female seen ovipositing on *Eriogonum nudum*.

27. *Philotes battoides intermedia* B. & McD. Flight period: June 25-July 13. Found on moist stream banks on lower slope of Mt. Judah. Several females seen around *Eriogonum nudum*.

28. *Celastrina argiolus echo* Edw. Flight period: June 17-July 15. Fairly common in all habitats. Food plant probably among *Ceanothus*, *Vaccinium*, *Spiræa*, and *Actinomeris* species (all recorded food plants) found in the pass area.

G. HESPERIIDÆ

1. *Thorybes nevada* Scud. Flight period: June 17-July 13. Abundant in dry and wet meadows. Food plant unknown.

2. *Pyrgus ruralis* Bdv. Flight period: June 17-July 11. Found in every habitat. Food plant probably *Potentilla drummondii* (larvæ known to feed on *P. tenuiloba* elsewhere).

3. *Pyrgus communis* Grt. Flight period: June 17-August 19. Abundant in every habitat. Particularly found around muddy places. Females seen ovipositing on *Sidalcea glaucescens* (Mallow Family) and larvæ found all summer.

4. *Erynnis juvenalis* Fabr. Flight period: June 19-July 25. Males collected on the 3 peaks and occasionally elsewhere; no females seen. Food plant unknown for this area.

5. *Erynnis afranius* Lint. Flight period: June 17-August 5. Males collected on the three peaks; 1 female collected in Lodge meadow. Food plant possibly columbine (food plant of the related *E. lucilius*)—*Aquilegia* grew in the meadows.

6. *Hesperia juba* Scud. Flight period: June 17-July 1. Occasionally seen in both dry and wet meadows.

7. *Hesperia nevada* Scud. Flight period: June 22-July 10. A large thriving colony was found at the very peak of Mt. Judah. Males appeared in late June and females appeared in early July. Females were observed ovipositing on a species of grass.

8. *Hesperia harpalus* Edw. Flight period: (August 8-August 11) A small colony was found on the lower slope (7,240′) of Mount Judah. Two females were seen ovipositing on a grass species, and other females were observed hovering over the grasses in this small area.

9. *Polites sonora* Scud. Flight period: June 23-August 25. Found in every habitat but most common in dry meadows. Food plant: likely grasses, as in other Hesperiinæ.

10. *Polites sabuleti tecumseh* Grin. Flight period: June 19-August 19. Distributed in every habitat but particularly common in the dry meadows (especially in Summit Valley). Most abundant in late June and early July, though the species was collected throughout the summer.

H. Possible Future Additions to the Butterfly Fauna of Donner Pass

Papilio brucei Edw. could be established in the area and overlooked in 1956 and 1960. Its food plant on Kaiser Peak (10,000 to 10,300 feet; Fresno County, California) reported by L. M. Martin to be *Cymopterus terebinthinus,* which was present on Mt. Judah (8,243′).

Colias eurytheme form *autumnalis* Cockerell might have been flying right after snowmelt in early June.

Euphydryas chalcedona macglashanii Rivers has its type locality as "Truckee" (10 miles east of the Pass) and Comstock (1927) notes it as occurring in the mountains north of Lake Tahoe in late June and early July.

Euphydryas chalcedona sierra Wright is common in the Lake Tahoe region, 15 miles from Donner Pass, and has been collected at Gold Lake, 30 miles north of the Pass.

Phædrotes piasus Bdv. is recorded from similar elevations in northern California and its food plant (*Lupinus*) is common in Donner Pass.

Ochlodes sylvanoides Bdv. was common in Squaw Valley (August 11, 1960), 10 miles southeast of the Pass. Apparently-similar habitats are available in the Lake Van Norden meadows.

Speyeria callippe juba Bdv. was found at Emigrant Gap, 15 miles west of the Pass area. Other *callippe* forms have been reported from the Lake Tahoe and Gold Lake regions.

Table I. DISTRIBUTION OF RHOPALOCERA SPECIES IN THE DONNER PASS AREA.

Species	Habitat									
A. PAPILIONIDÆ	1	2A	2B	2C	2D	3	4A	4B	4C	4D
Papilio zelicaon	—	—	—	—	—	—	X	X	X	X
Papilio indra	—	—	—	—	—	—	—	X	—	—
Papilio rutulus	X	—	—	X	—	X	—	—	—	—
Papilio eurymedon	X	X	—	X	—	X	—	X	—	X
Parnassius clodius	—	X	—	—	—	—	X	X	X	X
B. PIERIDÆ										
Neophasia menapia	—	—	—	X	—	—	—	X	—	—
Pieris sisymbrii	—	—	—	—	—	—	X	X	X	X
Pieris protodice	X	X	X	X	X	X	—	X	—	—
Pieris rapæ	X	X	—	X	X	X	—	—	—	—
Euchloe creusa	—	—	—	—	—	—	—	X	—	—
Anthocaris sara	X	X	—	—	—	X	—	X	—	X
Colias eurytheme	X	X	X	X	X	X	X	X	X	X
Colias philodice	—	—	—	X	—	—	—	—	—	—
C. DANAIDÆ										
Danaus plexippus	X	X	X	X	X	X	X	X	X	X
D. SATYRIDÆ										
Cœnonympha tullia	—	—	—	—	—	—	—	X	—	—
Cercyonis sthenele	—	—	—	—	—	—	X	—	—	—
E. NYMPHALIDÆ										
Speyeria cybele	—	—	—	—	—	—	—	—	—	X
Speyeria zerene	X	X	—	X	X	X	—	X	—	X
Speyeria coronis	—	X	—	—	—	—	—	—	—	X
Speyeria atlantis	X	X	—	X	X	X	X	X	X	X
Speyeria mormonia	X	X	X	X	X	X	X	X	X	X
Boloria epithore	X	X	X	X	X	X	X	X	X	X
Chlosyne palla	—	—	—	—	—	—	—	X	—	—
Chlosyne hoffmanni	X	X	X	X	X	X	X	X	X	X
Phyciodes campestris	X	X	X	X	X	X	X	X	X	X
Phyciodes mylitta	—	X	—	X	—	—	—	—	—	—

Polygonia zephyrus	X	X	X	X	X	X	X	X	X	X
Nymphalis californica	X	X	X	X	X	X	X	X	X	X
Nymphalis milberti	X	X	—	—	—	X	—	—	—	—
Nymphalis antiopa	X	X	—	X	—	X	—	—	—	X
Vanessa cardui	—	—	—	—	—	—	X	—	X	X
Vanessa atalanta	—	—	—	—	—	—	X	—	X	X
Vanessa virginiensis	—	X	—	—	X	—	X	X	X	X
Vanessa carye	—	X	—	—	X	—	X	X	X	X
Precis lavinia	X	X	X	X	X	—	—	—	—	—
Limenitis lorquini	X	—	—	—	—	—	—	—	—	—
F. LYCÆNIDÆ										
Satyrium californica	X	X	—	—	X	—	—	X	—	—
Satyrium sylvinus	X	X	—	—	X	—	—	X	—	—
Satyrium sæpium	X	X	—	—	X	—	—	X	—	—
Satyrium behrii	—	X	—	—	X	—	—	—	—	—
Satyrium fuliginosa	—	—	—	—	X	—	X	X	X	X
Strymon melinus	X	X	—	—	X	—	—	X	—	—
Callophrys johnsoni	X	—	—	—	—	—	—	—	—	—
Callophrys nelsoni	—	—	—	—	—	—	—	X	—	—
Callophrys augustinus	X	—	—	—	X	—	X	X	—	X
Callophrys eryphon	X	—	—	—	—	X	—	—	—	X
Callophrys dumetorum	X	X	—	—	—	—	X	X	X	X
Lycæna arota	—	—	—	—	X	—	—	—	—	—
Lycæna editha	X	X	X	X	X	—	X	X	X	X
Lycæna nivalis	X	X	X	X	X	—	—	—	—	X
Lycæna cupreus	X	X	X	X	X	—	—	—	—	—
Lycæna heteronea	X	X	—	—	—	—	X	X	—	X
Everes comyntas	—	—	—	—	—	—	X	—	—	—
Plebejus anna	X	X	X	X	X	X	X	X	X	X
Plebejus sæpiolus	X	—	—	X	—	—	—	—	—	—
Plebejus icarioides	—	X	—	—	X	—	X	X	X	X
Plebejus shasta	—	X	—	—	—	—	X	X	X	X
Plebejus acmon	—	X	—	—	X	—	—	—	—	—
Plebejus acmon lupini	X	—	—	—	—	—	—	X	—	—
Agriades glandon	X	—	—	—	—	—	—	—	—	—
Glaucopsyche lygdamus	X	X	—	X	X	X	X	X	X	X
Philotes enoptes	X	—	—	—	X	—	—	X	—	—
Philotes battoides	X	—	—	—	X	—	—	X	—	—
Celastrina argiolus	X	X	—	—	—	X	X	X	X	X
G. HESPERIIDÆ										
Thorybes nevada	X	X	X	X	X	X	X	X	X	X
Pyrgus ruralis	X	X	X	X	X	X	X	X	X	X
Pyrgus communis	X	X	X	X	X	X	X	X	X	X
Erynnis juvenalis	—	X	—	—	—	—	X	X	X	X
Erynnis afranius	—	X	—	X	—	—	X	X	X	X
Hesperia juba	—	X	—	X	—	—	X	X	X	X
Hesperia nevada	—	—	—	—	—	—	X	—	—	—
Hesperia harpalus	—	—	—	—	—	—	—	X	—	—
Polites sonora	X	X	X	X	X	X	X	X	X	X
Polites sabuleti	X	X	X	X	X	X	X	X	X	X

Discussion

From this study several factors important in determining the distribution of a species within a local habitat have emerged. The explanations for the "ecological preferences" of the butterflies in the Donner Pass area (and presumably elsewhere) fall ideally into the following categories.

I. Larval Food Plant

As pointed out in the introduction, the specific larval food plant required by most species limits the distribution of the butterfly to areas where the food plant grows. But within the geographical range of the food plant, two quite different distributions of the plant are possible: (1) a "closed" range, where plant and butterfly are confined to very restricted areas within a habitat; (2) an "open" range, where the plant and butterfly are widespread in a given habitat; or, alternately, an "open" range where the food plant is widespread but the butterfly is confined in distribution.

A. Closed Range

In some butterfly species, such as *Euphydryas editha* in the San Francisco Bay region, the adults seem to "choose" to remain within a very specific area despite the fact that its food plant is available in a somewhat greater area. This apparent "choice" factor Ehrlich (1961b) terms "intrinsic barriers" to dispersal.

In the Donner Pass area also, some species were found with apparent intrinsic barriers to dispersal. *Everes comyntas amyntula* and *Hesperia nevada* were restricted to the very top of Mt. Judah, and each species was always found within a few feet of its respective food plant, which was also restricted to the ridge (8,240′) here. With a constant, strong wind and the weak flight of *Everes,* any dispersal away from the food plant would seem to be dangerous for the survival of the species there. *Hesperia nevada* seemed just to "choose" to remain in this territory.

Examples from lower elevations also come out of the Lycænidæ and Hesperiidæ. Certain lycænids (*Lycæna heteronea* and *Satyrium californica,* for example) and skippers, such as *Hesperia harpalus,* were found only in the immediate vicinity of food-plant colonies. Such restricted plants are found only in areas with particular soil and moisture requirements. Willows, the larval food plant of *Limenitis lorquini,* are found only in wet areas and *Limenitis* stays among the willows, despite its strong flight. One might hypothesize that a specifically developed physiology (weak flight and a single food plant with specific

soil and moisture requirements) or an intrinsic "choice" factor (plus a single food plant) has caused these butterfly species to be restricted even within a habitat the size of those studied (refer to map).

B. OPEN RANGE

In this category we include food plants that enjoy a wide distribution throughout one or more habitats, and that have their corresponding butterfly species occurring with them. Examples are numerous: *Pieris protodice, Anthocaris, Colias, Chlosyne hoffmanni, Precis lavinia, Boloria epithore, Plebejus sæpiolus,* and many others.

C. OPEN FOOD PLANT RANGE BUT RESTRICTED BUTTERFLY DISTRIBUTION

This is a very common circumstance in temperate North America. The food plant will occur over a wide region, yet the butterfly species will be distributed in only part of the habitats available to it. (This, of course, is assuming the same elevation and general climate prevails throughout these habitats.) The following explanations are offered:

(1) The species is a weak flier and is only increasing its range very slowly. EHRLICH (1954) postulates that species of this nature (e.g. *Erebia*) may have wind as an important dispersal agent.

(2) The species may be a fairly strong flier but it never strays far from its its colony in a particular habitat. EHRLICH (1961b) has offered an *intrinsic barrier* explanation for this phenomena.

(3) The species (a weak or only fair flier) exists in a habitat surrounded by an almost insurmountable barrier, such as mountains, a forested area, or even a wide river. BAUER (1959) notes that the southward spread of *Erebia vidleri* Elwes and *Boloria chariclea* Schneider from Washington into Oregon has been barred by the Columbia River gorge.

(4) To the casual observer, habitats may appear to be suitable because of similar climate and elevation, but microclimates in the area may preclude any settling of the butterfly species. Besides severe cold in the winter, there may be flooding from spring runoff, lack of sufficient solar radiation due to frequent cloudiness or northerly exposure, an abundance of parasites and predators, feeding heavily on butterflies of the area (single strays from elsewhere would be destroyed too frequently for permanent settlement), and extreme temperature fluctuations within the immediate area of the food plants (bare rocks with sun reflection, for instance).

Three examples of this "open but restricted" phenomena in the Donner Pass area are offered from the hairstreak group. *Satyrium sylvinus* was found around willows at the base of Mt. Judah, but in Summit Valley (same elevation—about 6800 feet) the species was absent despite the abundance of willows. Food plants for *Callophrys eryphon* and *C. augustinus iroides* were quite numerous and widely distributed, but these hairstreaks were found only rarely in both 1956 and 1960.

II. Adult Feeding Plant

This distributional factor has not been noted by most authors, but in the Donner Pass area, the adult feeding habits of some butterfly species dictated the apparent distribution of the imagos. The most obvious examples of this intrinsic ecological factor were the members of the *Speyeria* group. The fritillary species were very rarely found in the moist areas where the larval food plant (*Viola* species) grows (and then only females). This is the complete opposite of the first case considered (I-A) where certain species were extremely restricted to the food-plant area. Instead, *Speyeria* occasionally would be seen flying very rapidly through dry meadows or on rocky slopes where no larval food plants were known to occur. We are indebted to L. M. Martin for pointing out that single-egg-laying species, such as *Speyeria*, often must fly a considerable distance between each oviposition. Usually, the adult *Speyeria* congregated around flowering Western Pennyroyal to feed during most of the day.

Thus preferences of the adult butterfly for a certain feeding plant can be very important in determining the distribution of some species within a habitat that may not even contain the larval food plant!

III. Strong Fliers or Inter-Habitat Migrants

Examples in this group are familiar to every North American lepidopterist: *Vanessa cardui, V. atalanta, V. virginiensis, Nymphalis californica, Danaus plexippus,* and *Polygonia zephyrus*. Members of this category often fly many miles and one or more thousand feet in elevation away from the nearest food plants.

Vanessa cardui and *V. atalanta* were found only at elevations over 8,200 feet, while thistles (food plant for *cardui*) grew to around 6,800 feet and no food plants were found for *atalanta*. No larval food plant for *Danaus plexippus* was available for many miles around, but individuals of this renowned migrant were seen rather frequently above 7,000 feet.

For two species (*Nymphalis californica* and *Polygonia zephyrus*), the larval food plant was found only in one locality, while the adults flew in every habitat. The strong flight of these species has granted considerable freedom of movement to the adults, and thus the butterflies often appear far from their larval food plants. Yet this "migrating" tendency does not imperil the survival of the species, for the adults hatch close to their food plants and can mate and lay eggs before flying off, or else can find new food-plant sources in their movements.

IV. Mountain-Top Attraction

No paper of this type would be complete without entering the "mountain-top controversy." We have already mentioned (III) the *Vanessa* species flying about the peaks. There were two other strong fliers in the study area that were restricted mainly to the highest peaks: *Papilio zelicaon* and *P. indra*. Elsewhere in California, *P. zelicaon* is found wherever a suitable food plant (Umbelliferæ) grows. On the Donner Pass peaks, the available food plant for both *zelicaon* and *indra* was *Cymopterus* and this plant's range included the tops of the peaks down to 7,100 feet. For these strong fliers, the winds along the high ridges and peaks may prove enticing, if one concedes that the species can indeed "choose" to remain there. On the other hand, the closeness of their food plant would make the adults' appearance around the peaks seem but natural.

Conclusions

Using the ecological data obtained from our research in the Donner Pass area, we have found *first* that the distribution of butterflies in a Sierran community is apparently governed by the inherent physiology of each species; in other words, by *intrinsic* factors. This physiology may be dependent upon one or more of the following factors: (1) the *larval food plant;* (2) the *adult feeding plant;* (3) the *development of wing muscles for flight,* i.e., how strongly or weakly the butterfly flies; (4) other *unknown intrinsic factors,* such as the preference of some species for mountain-tops and the lack of any dispersal tendency, as in *Satyrium sylvinus.*

Secondly, we have found that the distribution of butterflies depends upon various *extrinsic* factors which work on the *intrinsic* factors of each species. Among extrinsic factors we have noted climate, food-plant distribution, elevation above sea level, natural barriers to dispersal, wind, and presence of parasites and predators.

Thus in the search for explanations of butterfly distribution we must consider all the above factors, for each factor has its examples and many butterflies are not easily categorized. The real basis for the distribution and "ecological preferences" of a species must be sought in the evolution and adaptation of physiological mechanisms for exploiting a particular habitat in nature.

Summary

The local distributions, ecological preferences, and flight periods of 76 species, forms, and races of Rhopalocera in the Donner Pass area, Placer County, California, U. S. A., are reported. Factors involved in determining butterfly distribution are discussed. It is concluded that the distribution of a butterfly species is determined by (1) *intrinsic factors,* including larval food plant, adult feeding plant, strength of flight, and unknown factors, such as intrinsic barriers to dispersal; and (2) *extrinsic factors,* including climate, food-plant distribution, elevation above sea level, natural barriers to dispersal, and presence of parasites and predators. These extrinsic conditions work on intrinsic physiological factors, which have evolved for exploitation of a particular environment, and so determine the geographical range and local distribution of a species.

Acknowledgments

The authors are deeply indebted to Mr. William N. Goodall of the National Audubon Society, Director of the Audubon Camp of California at Donner Pass (Norden, California), where full cooperation for collecting data was extended to us during our service as assistants on the staff. Drs. Thomas Harvey and Kenneth Tanksley, members of the Camp staff, kindly furnished plant identifications. Thanks are due to Mr. Lloyd M. Martin, Los Angeles County Museum, who helped in determination of some Rhopalocera species and read the manuscript.

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SATYRIUM BEHRII (LYCÆNIDÆ) IN OREGON

Prompted by the recent record of *Satyrium behrii* Edwards from Nevada (Philip, *Journ. lepid. soc.* 15: 56; 1961) the Reverend A. I. GOOD, of Wooster, Ohio, wrote to inform me of his capture of the species in Oregon, another of the states whence *behrii* was previously unreported (cf. Clench, *in* Ehrlich & Ehrlich, *How to know the butterflies*: 192; 1961).

Rev. GOOD took a single fresh male on 5 July 1961 at John Day (Grant Co.), the only individual he saw in nearly a month of collecting in the area. He has generously presented the specimen to Carnegie Museum.

E. J. NEWCOMER, of Yakima, Washington, has also reported in correspondence the capture of *S. behrii* in Oregon. He took it at two localities: Camp Sherman (Jefferson Co.), 22 July; and Pringle Falls (Deschutes Co.), 23 July. There is also a record of the species from Ft. Klamath (Klamath Co.) in the Museum of Comparative Zoology at Harvard.

HARRY K. CLENCH, Carnegie Museum, Pittsburgh 13, Penna., U. S. A.

THE AUTHORSHIP OF THREE SCIENTIFIC NAMES OF NEARCTIC RHOPALOCERA VARIOUSLY CREDITED TO BOISDUVAL OR LUCAS

by CYRIL F. DOS PASSOS

In a recent paper by Dr. LINCOLN P. BROWER ("1958" [1959]: p.101) it is stated in a footnote "I have been unable to ascertain whether BOISDUVAL or LUCAS first described *P. eurymedon* and *P. rutulus* in 1852."

This problem actually involves an additional name to those mentioned above *i.e., Papilio zelicaon.* The authorship of these three names proposed in 1852 has been shifted back and forth over the years between BOISDUVAL and LUCAS and the time has come when this uncertainty should be put finally to rest.

All three names were published by BOISDUVAL (1852a) in a paper entitled *Lépidoptères de la Californie* and by LUCAS (1852) in a paper entitled *Descriptions de nouvelles espèces de Lépidoptères appartenant aux collections entomologiques du Musée de Paris.* BOISDUVAL appears to have presented his paper on the Lepidoptera of California at a meeting of the Entomological Society of France on 25 February, but it does not appear to have been published until August. These facts appear from a separate (1852b) of the paper and a reprint (1852c) bearing new pagination (pp.1-52), both of which are in the author's library. The latter paper has a title page dated 1852 and states that it is an "Extrait des Annales de la Société entomologique de France (août 1852)". On the other hand, LUCAS' paper has at the top of every even numbered page "(Mars 1852)". Hence, on the intrinsic evidence all three names must be ascribed to LUCAS.

The foregoing evidence appears to settle the matter insofar as intrinsic evidence is concerned and it would prove difficult to upset that conclusion by any extrinsic evidence, if it exists.

It should be observed that BROWER, in his references, ascribes the LUCAS paper to "M. H. LUCAS". The full name of LUCAS is PIERRE HIPPOLYTE LUCAS, but he usually signed himself H. LUCAS. The "M." stands of course for Monsieur. It was customary at that time in France to use the abbreviation M. before authors' names. Also the pagination of LUCAS' paper is 128-141, not 138-141 as BROWER cites it.

The foregoing study was made some time ago at the suggestion of Mr. Paddy B. McHenry of Burbank, California, who inquired about the matter while the present author was preparing his *Check List of Nearctic Rhopalocera* and I am indebted to him for calling the problem to my attention.

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THE FIRST RECORD OF *COLIAS NASTES* IN THE UNITED STATES (PIERIDÆ)

A single female of *Colias nastes* Boisduval was collected in northern Washington while the author was working on a forest lookout tower. This specimen was collected on July 13. A single male of this species was sighted five days later but eluded capture. The female agrees with Holland's figure of the species in every way except that the yellow coloring has a more greenish undercasting. The previously recorded range of this species is Labrador northward and westward (Klots, *Field guide to the butterflies*: p.33; 1951) and British Columbia. The exact locality of capture follows: Bunker Hill Lookout, near edge of a northern facing cliff, 7000 feet elevation, (T 40 N, R 19 E, S 16), Okanogan County, Washington, July 13, 1961, Jon Shepard collector. Both the male and female were discovered in association with Red Heather (*Phyllodoce empetriformis* (Smith) D. Don.). The specimen is in the author's collection.

Jon H. Shepard, 2315 Jackson, Corvallis, Ore., U. S. A.

NOTES ON NEOTROPICAL LEPIDOPTERA. 1. THE EARLY STAGES AND COMPARATIVE MORPHOLOGY OF TWO SPECIES OF *DYOPS* (NOCTUIDÆ) HITHERTO CONFUSED

by E. P. WILTSHIRE

Perhaps the most peculiar trees of the Neotropical forests, though not the most beautiful or majestic, are those of the genus *Cecropia*, known in Brazil as Imbauba; in English it is sometimes referred to as the Chandelier-tree, from its aspect, or the Ant-tree, from its myrmecophily.

During an all-too-brief stay of 18 months at Rio de Janeiro (see my general paper — *Journ. lepid. soc.* 13: 79-88; 1959), I decided to pay especial attention to the Lepidoptera and other insects attached to this genus of tree, and in a later article I hope to deal with the relations between various orders of insects on it. In this, my first special article on the Lepidoptera of the New World I shall deal only with two species of noctuid moth which I obtained in the forests fringing Rio only by breeding larvæ found on *Cecropia*. I suppose them to be monophagous on this genus, but of course cannot be sure.

The appearance of both these species of larva is of some taxonomic interest, as it differs from that hitherto considered to characterise the Quadrifid subfamilies of the Noctuidæ. These subfamilies are primarily classified by their hindwing neuration, but it is considered that they are also characterised by the less complete development of the larval abdominal legs. The Trifid group, of course, have five completely developed pairs, of roughly equal size. Many Catocalinæ (a subfamily of the Quadrifids) have five pairs, but the foremost pair, on abdominal segment 3, is smaller than that on segment 4. It now appears that the Dyopsinæ are an exception among the Quadrifids, as the pair on segment 3 is equal to that on segment 4, to judge from these two species. Both kinds of larva, moreover, have long single hairs of a sort never seen in the Old World on larvæ of Quadrifids.

Both I and Dr. H. B. D. KETTLEWELL, who was visiting Brazil when I found the first of the two (species no.2615), fully expected the larva to hatch into an Acronyctine or perhaps Arctiid moth; we were fooled by the long conspicuous single hairs, and the fully developed prolegs. We did not at first perceive that it lacked the rather dense tufts of hair of the genus *Apatele*, etc.; it reminded us of the Palearctic *Apatele alni*. A detailed description is given later of this larva, which is solitary.

When the moth emerged and proved to be a *Dyops* (there was little difficulty about determining the genus) it was a great surprise. Further examples were bred later in my stay, but the assistance of the British Museum was required to determine the species correctly.

As for the second species (no.2742), I only found the larvæ on one occasion, but as it was gregarious I was able to obtain more adults of it than of the first. This larva too, in its last instar, recalled an *Apatele* larva, but its earlier instars were so completely different from those of the first species, that it was again a great surprise when another *Dyops* hatched out.

On studying the material of this genus in the British Museum I found both forms confused in a series over the name *Dyops ocellata* Cramer; but the type of *Dyops cuprescens* Hampson, placed later, was in fact indistinguishable from the first, larger, species (no.2615). I found only slight differences in the male genitalia, and none in the female; it requires an experienced eye to distinguish the imagines by their pattern and superficial appearance, and without the clue given by the strikingly different larvæ the confusion in the Museum series might not have been rectified for many years. I must acknowledge the assistance of Mr. D. S. FLETCHER, without whom I would not now be able to give my conclusions on the correct names of these two species, with comparative morphology.

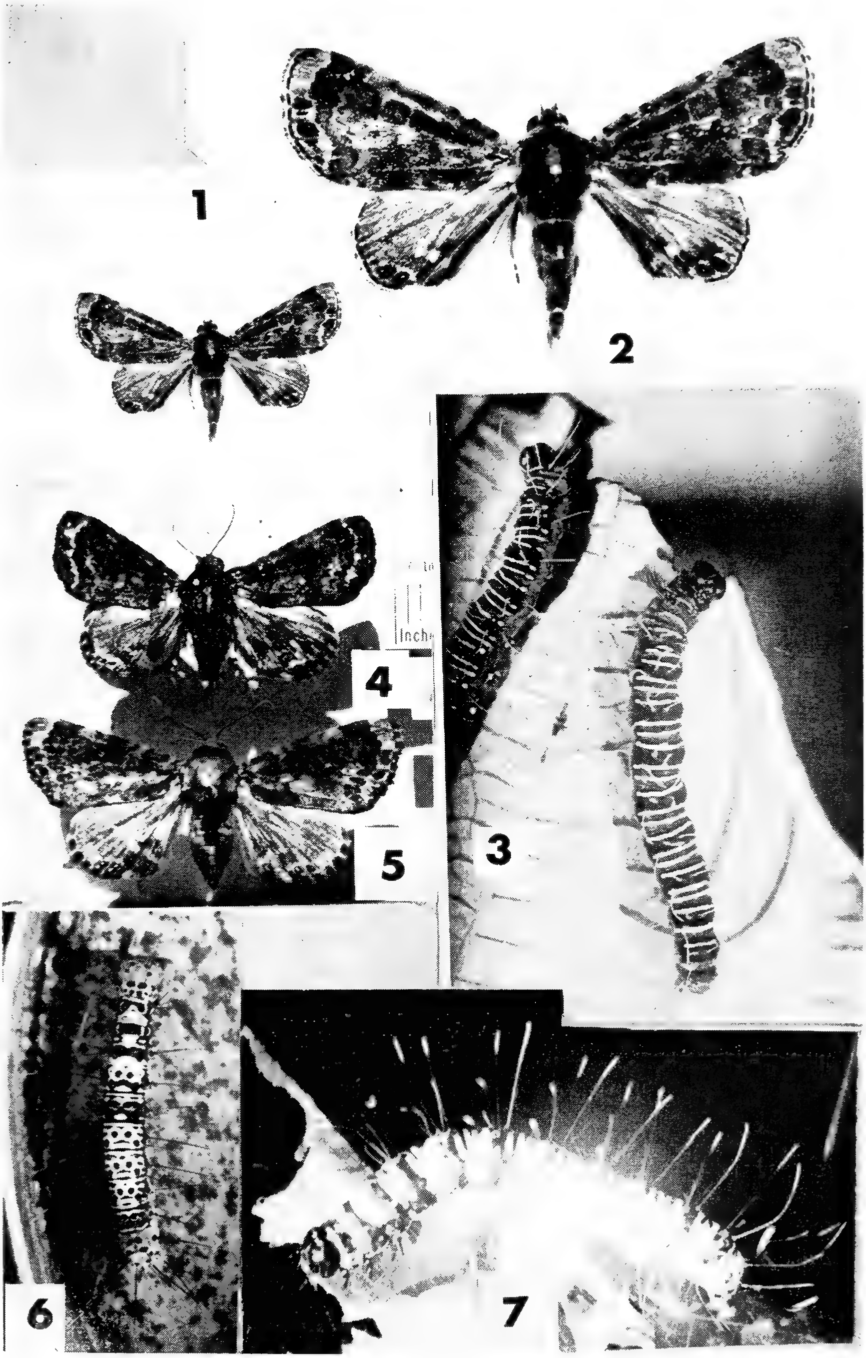
The two species, by priority of description, will come in the opposite order to that given above.

1. *Dyops ocellata* Cramer (no.2742) –

(1) *Dyops ocellata* Cramer [*Phalæna ocellata* Cramer (*Papillons exotiques* 3: pl.276, D, E; 1780)]. Dr. A. DIAKONOFF kindly informed me that CRAMER's type could not be found at Leiden. I select CRAMER's figure E as the LECTOTYPE, as I consider the two moths figured as not conspecific. CRAMER thought them the female (D) and the male (E) of the same species, but in fact the sexes do not differ in aspect or size in this genus, in my experience.

I also suggest that the British Museum's series from French Guiana should be neotypes (Plate 1: figs. 1 and 2).

Synonym: *Bœcula chromatophila* Walker, *List lepid. ins. British mus.* 15: 1669; 1858) for which I select as LECTOTYPE a ♀ in Hope Dept. of Entomology, University Museum, Oxford, "BRAZ. 276" (the type series of *chromatophila* is a mixture, but this selection disposes of the name).



1) — *Dyops ocellata* (French Guiana), NEOTYPE in British Museum (× 1); 2) — same (×2); 3) — same, full-grown larvæ (enlarged); 4) — *Dyops cuprescens*, Rio de Janeiro, Brazil, (×1); 5) — same, Asuncion, San Lorenzo, Paraguay, leg. H. Pearson (×1); 6) — same, penultimate instar larva (enlarged); 7) — same, full-grown larva (enlarged).

GUENEE's remarks on this species are an additional factor leading me to select *ocellata* as above, and are worth reproducing (*Hist. des insectes, Lep.* 6: p.283): –

"1088 *Dyops ocellata* Cr. 27 DE.

"38 mm. Ailes supér. d'un gris verdatre, avec les lignes médianes géminées, ondées et denticulées. Une grande tache foncée, subcarrée, saupoudrée, et entourée de clair dans la cellule et, au bord terminal entre les 2me et 3me inférieures, un petit oeuil noire à pupille blanche, double. Partie de la ligne subterminale qui le précède, d'un vert doré. Quelques points blancs près de l'apex. Coudée marquée de blanc au milieu. Ailes infér., d'un gris noiratre luisant, avec un double trait blanchatre à l'angle anal et deux petites taches ocellées, dont l'extérieure bipupillée et surmontée de vert-doré, entre les 2me et 4me inférieures. Derrière toutes les ocellées on voit, à certains jours, une bandelette cuivrée. Dessous des quatres ailes d'un gris jaunatre, avec les nervures plus claires, une forte tache cellulaire, une ligne médiane et une ombre postérieure noiratres, très marquées. Dessous de l'abdomen, avec une bandelette noire. Femelle semblable.

"Brésil. coll. Lefebvre, Saunders et Gn. On l'a envoyé en abondance des environs de Pernambuco.

"Nota, Cramer la dit de Cayenne et ses figures D et E paraissent présenter quelques différences, mais elles sont si grossières qu'il ne faut pas s'y arreter. Il sera bon de vérifier toutefois par la suite si l'espèce de la Guyane est complètement identique avec celle du Brésil, que je décris ici."

The "green grey" fore-wing colour, referred to by GUENEE for his Brazilian species, characterises the gregarious smaller species (2742) taken by me. The larger, solitary species (2615) has a purple-brown ground.

The British Museum has a good series of both from French Guiana and Brazil; and after making preparations of the genitalia of several of each, Mr. D. S. FLETCHER found that the male's valve-apex afforded a good character, and kindly sent me sketches of this. My own slides, made from my material, corresponded well to those sketches, and figures 8 and 9 were made from them; fig.10 was made from Mr. FLETCHER's sketch of a species I do not possess, which can also be distinguished by the valve apex. It will be seen that the valve terminates in a short membranous flap with short hairs: in *ocellata* (fig.8) this flap continues in a straight line from the costa to its point, from which its ventral border curves away at an acute angle to merge in the valve's chitinous ventral border; in *cuprescens* (fig. 9) the flap's point is roughly midway between costa and ventral border, forming a right angle and being obtusely angled to the costa; in *dotata* Walker (fig. 10) the costa and ventral borders taper to a very acute tip.

8) – *Dyops ocellata*, ♂ genitalia, ventral open view, with ædeagus detached; 9) – *D. cuprescens*, ♂ right valve tip; 10) – *D. dotata*, ♂ left valve tip. All drawings to same scale.

EARLY STAGES (2742).

On November 2, 1958 I found on a single low leaf of a *Cecropia* sapling on the side of the Rua Redentor, Corcovado Mountain, Rio, at about 500 m. height, a gregarious mass of nearly fifty larvæ nearly 1″ long, slender and glossy brown, with black heads and scanty black hairs which were inconspicuous. The head and tail were slightly raised; all feet were black; there were five equal pairs of abdominal feet. The larvæ rested side by side touching each other, and usually fed in the same formation. They resembled a putrescent jelly-like mass and were repulsive, both in this and the next instar. On November 6 they moulted gregariously; after this they were orange-brown in colour, 22-25 mm. long.

On November 18 they again moulted gregariously; and immediately after, the larva-mass appeared darker, as though mouldy, this impression being given by the fresh white hairs on the new dark skins. A little later, they separated to feed and ceased to be gregarious.

Mature larva (fig.3 of Plate): black, with three fine white transverse dorsal lines on each somite and an orange-brown lateral stripe running the length of the body; head glossy black; feet black; ventral surface, with a few transverse short lines.

Foodplant: *Cecropia,* and occasionally if nothing else was offered, the foliage of two other trees.

Cocoon: silken, firm, with debris adhering to the outside; I am uncertain where it is placed in the wild state, but presume on the ground, perhaps below the surface.

The moths started emerging on November 27, and about forty had hatched by the end of the month. Many were under-sized due to the difficulty of providing enough of the right foodplant daily; no more moths emerged after December 30. Probably the phenology of this moth is like that of the following species, *i.e.* multivoltine with "winter pause", but as only one generation has been bred, this is a guess. In an equatorial climate the "winter pause" would, I suppose, not be made.

The adult moth, when disturbed, falls on its back and flutters jerkily vibrating its wings and body and revealing the lighter, more orange and banded under-side colouring; this is possibly a mimicry of Hymenoptera and may be in an early stage of evolution. It might, alternatively be an exhibition of deceptive or "flash" colouring before suddenly settling.

2. (no.2615) *Dyops cuprescens* Hampson 1926

This was named by HAMPSON in *Descriptions of new genera and new species of Noctuinae* 128. The ♀ of CRAMER's *ocellata* (Pl.276 D) appears identical with both sexes of this species. HAMPSON's type, from Chaquimayo, S. Peru, is in the British Museum.

This species is on the average larger than the preceding and can usually be distinguished from *ocellata* by its purple-brown fore-wing ground-colour. See also figure 9 for the valve-tip of the male, and remarks under *ocellata* above.

EARLY STAGES (2615).

I have found the half-grown and full-grown larvæ on the underside of larger leaves of young *Cecropia* trees, feeding by day but hidden. They are usually found singly, but when small are sometimes found two together.

Fourth (?) *instar*: about ¾″ long, resembling bird-excrement, brown, slender, shiny, with dorsal white patch on somites 4-9, and paler brown

ventrally. Head yellow brown. Setæ black, white-ringed, with rather long black hairs. A slightly larger larva, observed on another occasion was bluish white, suffused with yellow near the spiracles and on somite 11; the head was yellow with four black spots as big as the setæ (see Plate 1, fig.6).

Next instar. the head is glossy black, some of the hairs have thick tips, and the length of the larva is 1″-1½″ (see fig.7). On the slightly enlarged 10th somite there are two dark patches above two lateral warts; these patches may be brown or black. The dorsal and ventral areas are white with heavy black setæ, recalling European *Cucullia* larvæ; between the two posterior setæ of each somite is a short black transverse bar; there are also other transverse black bars of varying length on each somite and these tend to become broader laterally; in the darkest forms these black markings coalesce so that the setæ no longer appear as distinct black spots, and the white colouring is reduced to the extent of forming two creamy transverse dorsal bands, and a pair of creamy lateral spots on each somite. One larva found full-grown was feeding on the underside of a large leaf with only its head shewing. When I picked the leaf it stopped, threw back its head in alarm and assumed a dead, squashed appearance, looking rather limp and mouldy. A small dipterous fly was noticed trapped in the hairs of this individual and appeared lifeless. A pre-pupal change of colouring affects the sublateral and ventral areas which turn deep crimson, leaving the dorsal area creamy white dappled with black.

Cocoon: silky, firm, with debris adhering; pupal period, about three weeks.

Phenology: multivoltine with a probable diapause in the cool season; apparently there are four broods during the warmer half of the year at Rio. Larvæ of the first are full-grown in early November and produce moths in early December. A full-grown larva was also found in early January and would have produced a moth in mid-February had circumstances permitted completion of rearing. Half-grown larvæ found in April produce moths in late April and early May. Half-grown larvæ found in mid-May produce moths in late June. Whether there is really a diapause in July-October, and in what stage, is uncertain.

Pupa: glossy dark brown, heavily chitined, of normal noctuid aspect, without bloom. The wings cover part of the first five abdominal somites, leaving the next five clear and entire cremaster, consisting of seven short, straight, sharp, well-separated spines, on a blunt, rounded rump.

3. Other Dyopsinæ

Although I have personally come across only the above two species, it may be of interest to add a few words here about other species in this sub-family which appears to be endemic Neo-tropical.

The whitish-banded form *Dyops dotata* Walker has been placed in the British Museum as an aberration in the *D. ocellata* series, but Mr. D. S. FLETCHER after investigating the male genitalia came to the conclusion that it was also distinct (see fig.10 for its valve tip.).

The remaining *Dyops* species in the British Museum are easily distinguished from the above three; their names are: *chlorargyra* Hampson, *cyanargyria* Hampson, *pupillata* Felder, *subdifferens* Schaus; and, placed in a separate genus (*Eudyops* Hampson), *xantholepis* Dyar.

Immediately following GUENEE's description of *ocellata* quoted above are the descriptions of two further *Dyops* species: 1089. *Dyops oculigera* Gd. (38 mm.) and 1090. *Dyops hatuey* Poey (58 mm.); of these two I have no knowledge and can express no opinion.

SUMMARY

Two species of *Dyops,* widespread in Central and South America and hitherto confused, have been studied and bred in Brazil.

Dyops ocellata is the smaller species; fore-wing greenish brown in ground-colour. The larva is gregarious at first and in its last instar is black with creamy white hoops and orange lateral stripes, and has long single hairs. A lectotype and a synonym of *ocellata* are given.

Dyops cuprescens is the larger species; fore-wing purplish brown in ground colour. The larva is solitary or found in couples at first; it is whitish with black spots and bands and long hairs thickened at the end.

Both larvæ have ten abdominal prolegs equally developed; this, together with the long hairs, distinguishes them from the larvæ of other sub-families with which this genus has been placed. The foodplant is *Cecropia,* a myrmecophilous tree.

Political Agency, P. O. B. 114, BAHRAIN

PRELIMINARY NOTES ON THE LIFE HISTORY OF *CALLOPHRYS* (*SANDIA*) *MAC FARLANDI*

by Don B. Stallings, J. R. Turner, and Paul R. Ehrlich

It is evident that the proper description of the life history of *Callophrys* (*Sandia*) *macfarlandi* Ehrlich & Clench will have to wait until detailed comparative studies of related Hairstreaks can be made. It therefore seems that a preliminary report of our knowledge is in order at this time.

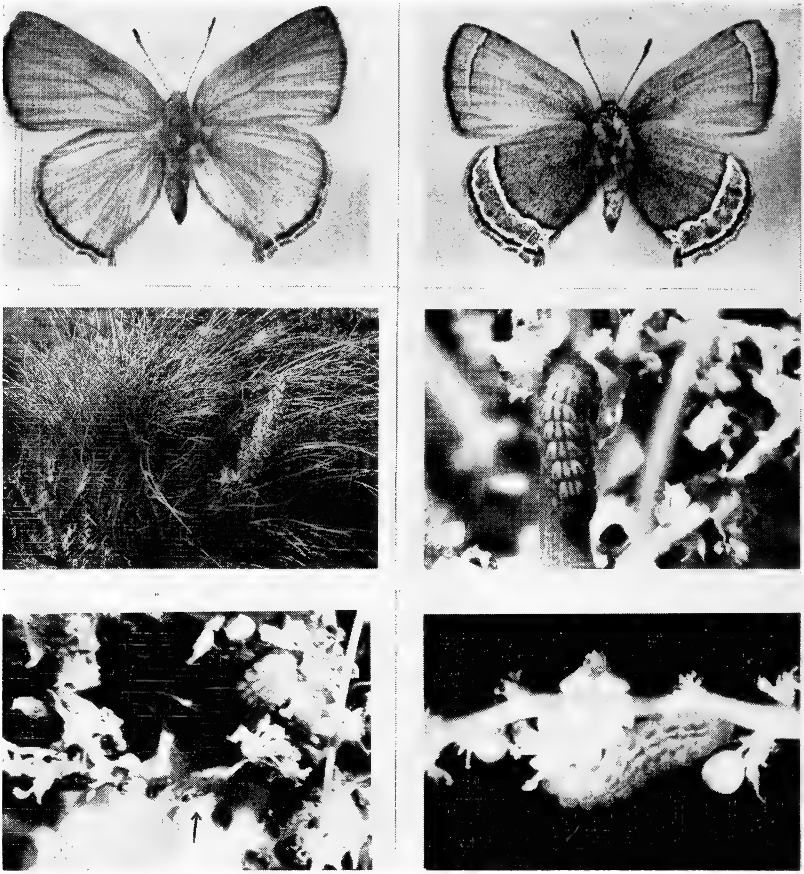
The egg appears to be typical of the Lycænidæ: a pitted oblate spheroid. In the single observed instance of egg laying, the female deposited the egg on a lateral stem near the main stem of the flower stalk. Other eggs were observed on the sheath at the base of the stems of the flower stalks. Undoubtedly all instars of the larva have been observed and preserved, although no single individual has been raised from egg to adult. Therefore we do not know the exact number of instars.

The larvæ were characteristically slug-shaped and were extremely variable in color. The main color range was from a human flesh color to dark maroon. This range of color included over 75% of the specimens. Several larvæ were of a distinct pink color, and a single specimen was light green. In pattern some were immaculate and others had several rows of chevron stripes and spots. More than 200 larvæ were examined.

The larvæ feed primarily on the blossoms of *Nolina mircocarpa* S. Watson (Agavaceæ), a Beargrass. However, we observed some of the larger larvæ chewing pits into the stem of the bloom stalk. Most larvæ were found at rest on the main and lateral stems of the bloom stalk and often concealed themselves in the sheath at the base of the stems. Even those larvæ feeding on the blossoms were camouflaged well enough, by their color and markings, that they were not seen at first glance. An unidentified species of ant was attending the larvæ.

No pupæ were found in nature, so the pupation site is unknown. The form of the pupa is typical of the genus.

The flight of the adults is rather rapid and erratic, and our observations indicated that they remained close to the location of the larval food plant. The flight during the day is rather limited. Nearly all specimens found in flight were sighted between 9:00 A.M. and 10:30 A.M. Adults were observed to spend the night deep in the basal rosette of the food plant. The main flight in 1959 appeared to be during the first three weeks of May. Some of the mature larvæ that we collected were permitted to



Callophrys (*Sandia*) *macfarlandi*: top left — upperside; top right — underside; middle left — *Nolina microcarpa*, the foodplant; middle right — larva feeding on blossoms (dorsal); bottom left — two larvæ feeding (note attending ant above arrow); bottom right — larva feeding (lateral).

pupate. Some of these then emerged the last part of May and early in June; the remainder did not emerge until the following year. Some fresh specimens of the second generation were taken in flight with the more worn specimens of the first generation.

The type locality is on the dry west slope of the Sandia Mts., in Bernalillo County, New Mexico, just north and east of Albuquerque. The exact locality is the La Cueva Camp Ground in La Cueva Canyon. The holotype was caught some 10 yards east of the stone shelter house at the camp ground, and many in the type series were taken in the

Type locality of *C. macfarlandi*; PAUL EHRLICH and JACK STALLINGS collecting in foreground.

immediate vicinity. About the only other butterflies common at the type locality at the time the type series was collected were *Apodemia mormo* Felder & Felder and *Callophrys* (*Mitoura*) *siva* Edwards. *C. macfarlandi* appears to be more abundant in Tijeras Canyon, a short distance from the type locality, and collectors are urged to seek it in this area rather than at the type locality.

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WILD SILK MOTHS OF THE UNITED STATES, SATURNIINÆ, EXPERIMENTAL STUDIES AND OBSERVATIONS OF NATURAL LIVING HABITS AND RELATIONSHIP. By Michael M. Collins & Robert D. Weast. Collins Radio Co., Cedar Rapids. 138 pp. Available from: Wild Silk Moths, 201 34th Street, Cedar Rapids, Iowa, U. S. A.; price $4.25.

This little book (may be read at a single sitting) contains a great deal of useful information on the species of giant silk moths occurring naturally in the United States of America. This includes moths of the saturniid subfamily Saturniinæ mainly, but the genus *Automeris* (Hemileucinæ) is included also because of its popularity with amateur breeders.

The book is copiously illustrated with excellent photographs (although somewhat light in tone, no doubt from the reproduction process) and is organized into two main parts: Part I, United States species, under which are discussed, for each species, (1) habitat, (2) breeding habits, (3) breeding in captivity, and (4) collecting; general remarks are given also under each genus or subgenus; Part II, Studies and experiments, under which are discussed, (1) population dynamics, (2) breeding flights, (3) parasites, (4) diseases, (5) breeding, and (6) hybrids.

There is a nearly complete coverage of species and subspecies and the discussions are detailed and mostly based on personal observations by the authors. Much new information is recorded also. In these respects lies the greatest value of the book both to the non-professional collector and breeder – he may find reliable information to aid him in obtaining and rearing not only the better known eastern species, but also the lesser known southwestern species as well – and to the research worker – he may utilize the first-hand biological data in comprehensive studies on phylogeny, physiology of sexual attraction, geographical distribution, etc.

Critically speaking, I find a few dubious or meaningless statements, such as, "They [the larvæ of two species] have gaudy, scarlet tubercles which *make them appear* poisonous or dangerous." (p.80), and "Once the scent is detected, the male flies against the wind. This action suggests the use of *eyesight* for determining the wind direction." (p.91) [italics mine]. Also disturbing are the sometimes loose style, incompletely cited and scarce source references, non-italicized latin names, and capitalization of the initial letter of species-group names. Some of these points may be excused because the book is not intended as a scientific work.

All in all, I would say that the authors' purpose is well served by their book, " . . . to present various aspects of the subject with the hope of creating enthusiasm and to be of help to the breeder or student who plans to do work with these fascinating insects."

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FIELD NOTES

AN ALBINO *LYCÆNA PHLÆAS* IN CONNECTICUT

In August 1960 I had a rather interesting experience while hunting in a field in Portland, Connecticut. I was working in a large open field which had a depression at one end. In the depression grew a heavy mass of a pinkish red flower about 2 feet tall. In this depression and on the flowers were swarms of *Lycæna phlæas americana.* No sorrel was apparent; consequently I stood wondering what the attraction was. While I was still pondering the question, a small *white* butterfly appeared on the scene which I did not immediately recognize. To my amazement it turned out to be a white *L. p. americana.* By "white," I mean *pure white;* I have previously found very light pinkish forms. This specimen is identical with the normal form as to spots, etc.

To me the more interesting feature was the fact that it settled on *the only white flower* in the patch, which makes me ask: did it know it was white, and choose the white flower intentionally? Are butterflies that colour conscious? Further afield there were large patches of the same white flowers, but a search turned up no more white freaks.

The specimen in question is in my collection at Cassadaga.

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A WHITISH *LYCÆNA PHLÆAS IN OHIO* (LYCÆNIDÆ)

One of the more accessible collecting areas near the community of Wellington, Lorain Co., Ohio, is Findley State Park, located two miles south of the village on Ohio State Route 58. The park consists of nearly 900 acres, a large part of which was originally woodlands. In 1954 a shallow valley, through which a small stream flowed, was cleared and an earth fill dam was constructed at the north side of the park. This created an artificial lake of about 90 acres. With access roads, cleared picnic areas, and an artificial bathing beach, the park has become a center of summer outdoor recreation in this area. Plantings of native and introduced trees, made about 30 years ago, are in various parts of the park. These are mostly species of *Quercus* (oak), *Betula* (birch), *Liquidambar* (gum), and various conifers.

The afternoon of August 10, 1961 was sunny with scattered cumulus clouds, temperature in the middle eighties, but with a gusty wind of

about 16 to 18 miles an hour from the south-southwest. I was collecting on this afternoon in the above described park, following a service road which led through a brush-filled area and into an open meadow-like field of about 20 acres in area.

About 2:30 P.M. (EDT) and at the point where the drive entered the field, I saw a small butterfly darting around in a belligerent manner. Not recognizing it, I attempted to net it on the wing, but failed. It returned almost immediately, and this time alighted upon a small patch of bare ground in the drive. Thinking it to be some species of Blue not common to this area, I carefully netted it as soon as it arose from the ground, papered it, and continued my collecting.

Returning home, I examined my catch. To my utmost surprise, I found this to be a specimen of *Lycæna phlæas* Linnæus. A perfect male, it lacked completely any red or coppery red color, both on the upper and under surfaces of the primaries and secondaries. Instead, this color was replaced entirely by white or silvery white areas, although the dark gray and black portions were of normal color and design. A rather striking appearance was created by this coloration, or rather, lack of it.

Examination of the white areas under a microscope at 200 × reveals that these scales are curled or rolled, giving them an almost quill-like appearance. Similar areas on a normally colored specimen reveal flat shingle shaped scales. This suggests that the loss of refractive power of the curled scales results in the loss of the coppery red color, leaving a colorless or white area.

At the present time, this specimen is in the writer's general collection. Subsequent intensive collecting in the area of capture failed to produce any similar individuals, although many normal specimens were taken.

The complex genetics regarding this type of aberration is not completely understood by the writer; but it is felt that a report of such a specimen should be a matter of record, perhaps helping to contribute to information concerning the frequency and distribution of such a form.

I would like to thank Harry Clench of the Carnegie Museum and Prof. A. B. Klots of the American Museum of Natural History for their interest expressed in this specimen and the encouragement for this article. Special thanks to P. Siviter Smith of Birmingham, England, for his suggestion of the microscopic examination of the structure of the colorless scales and the observed results. Also the information that this may be the rare form "alba" (Tutt), although this form name is apparently not well known to general collectors in this country.

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LARVAL NOTES ON *CHLOSYNE LACINIA* AND *C. CALIFORNICA*

On 3 Sept. 1961 a few larvæ of *Chlosyne lacinia* Geyer were found among a larval colony of *Chlosyne californica* Wright, apparently at home in this communal association. The few orange caterpillars of *lacinia* were conspicuous among the dark *californica* larvæ.

At the time, colonies of *C. californica* in various instars were plentiful on Desert Sunflower, *Viguiera deltoidea* var. *parishii* in Sentenac Canyon on Highway 78, ten miles northeast of Julian, San Diego County, California. However, these few *lacinia* caterpillars were found only in one gregarious assemblage of perhaps a hundred fourth instar *californica* larvæ. The butterflies were reared out by WILLIAM HEDGES; hence identification is confirmed.

Chlosyne lacinia is not common in San Diego County although conditions appear quite favorable for it in Borrego Valley. Normally the caterpillars prefer *Helianthus annuus,* and can be found in large quantities in the fall in Imperial Valley on roadside patches of sunflowers. This record on *Viguiera deltoidea* probably represents a new host plant record.

Chlosyne californica on the other hand is one of the dominant species of the desert canyons of this area whenever rainfall is favorable, and the butterflies appear in large numbers at times. The caterpillars accommodate readily to *Helianthus annuus* in captivity but I have never observed them on anything but Desert Sunflower in nature.

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TWO NEW FOODPLANTS OF SOUTHWESTERN SATURNIIDÆ

The hosts of *Agapema galbina anona* Ottol. and *Citheronia splendens* Druce were discovered September 1 and 2, 1961, in Brown's Canyon of the Baboquivari Mountains of Pima Co., Arizona. While making a detailed search for *Rothschildia jorulla cinctus* Tepper, I quite accidentally came upon a cluster of cocoons of *A. galbina anona.* The host is a species of *Lycium,* which is a very thorny, sparsely-leaved shrub. Previously I had spent considerable time trying to locate the moth in its known areas of occurence in the Santa Rita and Santa Catalina mountains without success. Once the precise foodplant was determined I was able to find the cocoons in considerable numbers.

The cocoons are spun in a cluster towards the center of the shrub, being completely surrounded by dense thorns. This affords excellent protection from birds and rodents. The clusters frequently contain more than a dozen cocoons. The gregarious larvæ must sometimes completely defoliate the host. I collected cocoons along the canyon's slopes, which are hotter and drier than the canyon's floor, where the cocoons can also be found. The adults fly in November and early December and are usually taken at "black light". *Lycium,* where found, is common, but it does not seem to be as widespread as are other common plants of the area. *Lycium* grows in association with various cacti, agave, acacia, mesquite and ocotillo, but it is frequently missing from habitats containing these plants.

A mature larva of *Citheronia splendens* was taken on wild cotton, *Gossypium thurberi.* This plant grows along canyon streams and in other moist situations. This striking larva had evidently completed its full growth on the plant. It pupated in mid-September. *C. splendens* is also reported to feed on walnut trees which grow throughout the mountain ranges. The species flies in July.

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ADOPŒA LINEOLA (HESPERIIDAE) NOW ALSO IN NORTHERN ONTARIO

On July 9, 1960, the author observed on a roadside near Sudbury, Ont. (Richard Lake), a skipper which looked to him like *Adopœa lineola.* It was, however, then not possible to secure the specimen. On July 16, 1961, the first specimen of *Adopœa lineola* was quite accidentally caught about 300 yards away from the spot of the 1960 occurrence by John Denchuck, a Sudbury High School student interested in Lepidoptera and accompanying the author on a field trip. This brought the indisputable proof that this little skipper is extending its range now into northern Ontario. On July 17, 1961, the author took a second specimen and this at the spot where the species was observed a year ago. It certainly will be interesting to see at which rate *Adopœa lineola,* which is now still quite rare, will increase in coming years.

The specimens are in the collection of the American Museum of Natural History in New York.

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MIGRATION OF *NYMPHALIS CALIFORNICA* IN WASHINGTON (NYMPHALIDÆ)

During the week of July 16 to 22, 1961, an immense migration of the butterfly *Nymphalis californica* was noted in the high mountain country of the State of Washington. Reports indicate that on all the major mountain passes in the state this butterfly was in such great numbers as to slow traffic and clog radiator grills. The greatest numbers were observed at an altitude between 3500 ft. and 4000 ft. although reports have been received of observations up to at least the 5000 ft. level. This area, at least in the eastern part of Washington, is at about the upper level of the Transition Zone or even the lower part of the Canadian Zone. Yellow Pine, fir, Western Larch, spruce, Jack Pine, poplar, alder, willow, and aspen abound in this area and in the open spaces wild lilac, spirea, and Buck Brush (*Ceanothus thyrsiflorus*) are in bloom then.

On a trip from Oroville to Spokane on July 16, we first saw this butterfly swarming in a large sunlit rock cut on the summit of the pass between Disautel and Nespelem at about 9:30 in the morning. This pass is on Washington state highway 10A. There were mud puddles at the edge of the road and many butterflies were drinking or resting on the ground along the side of the road. There were many dead and feeble ones on the ground but we were unable to determine the cause, whether from the passing cars, fatigue, disease, or some other cause. There did not seem to be any predators or parasites bothering them at the time. We took pictures and gathered specimens at this time and noted that taking them was much easier than is normal. Having no net we merely picked them up from the road side. Their flight was abnormally feeble.

On the return trip on July 20, over Sherman Creek Pass on State Highway 3P we took specimens, although at that time the flight was not nearly so great as it had been early in the week.

I have reports of this butterfly in great numbers on other passes and mountain country in the State of Washington. They were seen on Blewett Pass on July 17, in the Tiffany Lake area of the Okanogan National Forest west of Omak Wash on July 23, and in the Lost Lake and Bonaparte Lake area east of Chesaw, Wash., and north of Wauconda, Wash., at various times during the same week.

On July 24, we returned to the Republic and Swan Lake vicinity and could find no trace of the butterflies. From this fact I believe that this was a migration rather than a large hatch. I was unable to determine in which direction they were migrating.

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ESPECIALLY FOR FIELD COLLECTORS

(Under the supervision of Fred T. Thorne, 1360 Merritt Dr., El Cajon, Calif., U.S.A.)

COLLECTING *ŒNEIS NEVADENSIS* (SATYRINÆ) AND OTHER GENERA ON VANCOUVER ISLAND, WITH A THEORY TO ACCOUNT FOR HILLTOPPING

by Richard Guppy

The discussion on "hilltopping" butterflies, which has somewhat died out in recent years, was in 1960 revived in my mind by a rather good season for *Œneis nevadensis.* This butterfly is by all accounts the most inveterate hilltopper in this part of the world.

The spot in which I collect most of my *Œ. nevadensis* Felder is actually the top of a ridge, rising quite steeply up from the seashore. It is by a rough estimate, perhaps 500 ft. high. On the landward side the slope is much more gentle; from my home it takes me about ten minutes to walk to the top of the ridge, although the ascent from this point is probably no more than 200 to 300 ft.

The butterflies are found always along a short stretch of the ridge, about 50 yards altogether, which I suppose must be the highest point. This area is divided into three "compartments", small clearings separated by clumps of Arbutus and stunted Douglas Firs. In 1960, for about two weeks in the latter part of June, I could almost depend on finding each of these compartments occupied by a male *Œ. nevadensis,* which when collected, would be replaced by the following day.

If it were not for their stubborn insistence on staying in their chosen small area, these butterflies would not be easy game by any means. With most of the more active and wary butterflies, a missed swipe means that the insect will clear out in a hurry, and give the collector no second chance. But these hilltop *Œneis* will circle repeatedly; often the collector is able to get in five or six successive tries, and even if he finally frightens the butterfly off, only a little patience is needed; in ten minutes or so it will be back.

These hilltop *Œneis* are all males. Females I very seldom find, and always in localities at some distance from where the males like to disport themselves. Having considered all this evidence, I have arrived at the conclusion that this hilltopping business is simply a means by which the males and females are brought together. The problem of finding mates

that are other than siblings, must trouble most insects, and it must be admitted that not all solve the difficulty by hilltopping. Among butterflies some, notably the Lycænidæ, would not meet with the problem, because they tend to form colonies, which remain in one small area, where the necessary host plant is plentiful.

In spite of these objections, it seems certain that, in the case of species that wander a great deal, some instinct that would draw all newly emerged individuals towards a central point would serve them in good stead. Suppose that every *Œneis,* on emerging, is possessed of an urge to fly uphill. The males, which are always on the wing before the females, will become concentrated at certain high spots. The females will then begin to arrive at these meeting places. It is a known fact that the behaviour pattern of a female insect may change after mating. We can suppose then that since the female *Œneis,* on reaching a hilltop, will immediately meet a male, she will shortly lose her uphill instinct, which will be replaced by an urge to search for a suitable place for oviposition. The strongest support for this part of my theory lies in the fact that, if females did not fly up to the hilltops, the males which persisted in staying there would get no mates. That being so, natural selection would inevitably eradicate the habit. The short stay necessary for the females to complete business and move on would mean that a collector could easily miss seeing them, if he were in the habit of stopping only long enough to collect any males in residence at the time.

An interesting aspect of the problem, for which I have no good explanation, is the way in which males can establish and hold a territory. On most peaks, only one is present at a given time, unless there is quite a plateau, in which case several will remain about 50 yards apart. At that distance they apparently cannot see one another. The tree clumps on my ridge, by screening the butterflies from sight of one another, allow three males to occupy quite a small area. When a male comes into a rival's territory, the two flutter around each other for a time, then one, which I cannot say of course is always the trespasser, will clear off out of sight. Why it should do so it is difficult to say, since the other male obviously cannot hurt it. But the utility of the system is evident. Each male is under the necessity of investigating every butterfly which comes into its range of vision, in case it should prove to be a female of his species. Two males remaining continuously in sight of one another, would create an intolerable situation.

It seems probable that some species that are not hilltoppers use the rendezvous system, although with these the means by which the meeting place is selected remains a mystery. I know of spots near my home where,

year after year during the correct season, I can go each day to collect the current male *Limenitis lorquini* Bdv., which will be replaced each time just as are the *Œneis* males on the ridge. But these *Limenitis* spots have, so far as I can make out, absolutely nothing to set them apart from the rest of the scenery. They are not at the tops of hills, but often on a slope.

While on the subject of hilltoppers, I would like to add some further information that has come to light, regarding our other inveterate hill-topper, *Papilio zelicaon* Luc. In this journal (Vol.7: 43-44; 1953) I stated that on Mt. Arrowsmith there were no suitable host plants for *P. zelicaon*, and that to reach the summit from the nearest stand of umbelliferous plants, they would have to fly about five miles over, or through, dense forest. In 1960, while on my annual collecting trip to Mt. Arrowsmith, I noticed a butterfly of this species, behaving in a suspicous manner. So certain was I that it was engaged in oviposition, that after an unsuccessful attempt to collect it, I returned to examine what had appeared to be a patch of rocks supporting a few lichens and mosses. Close examination revealed a number of tiny plants, just coming into bud. So small were they, and so closely appressed to the rock, that any one of them could have been hidden by a silver dollar, yet in the aggregate there were enough to feed several *P. zelicaon* larvæ. I took home a sample, and in water the buds opened into tiny yellow umbels. They were undoubtedly a species of *Lomatium*, very probably *L. martindalei* C. & R. I could find no ova on any of the plants, but it is, after all, immaterial whether the butterfly was ovipositing or not. By looking as if it were laying eggs, it had led me to discover on Mt. Arrowsmith an umbelliferous plant which I had not noticed before, and which certainly could account for the presence of *P. zelicaon* in the vicinity.

R. R. 1, Wellington, B. C., CANADA

The artist who prepared the figure for the front cover for Volume 16 is again WILLIAM VARS, of Yale University.

COLLECTING IS STILL GOOD IN THE NORTHWEST

by E. J. NEWCOMER

The increasing use of insecticides and herbicides in the West, the construction of dams and super highways, the occurrence of forest fires, all are reducing the good collecting areas for the lepidopterist. But many very rewarding areas remain, and will continue to exist for many years.

Instinctively the butterfly collector looks for open places — natural meadows, gravel-storage areas, railroad rights-of-way, abandoned highways, skiing slopes. For the combination of sunlight and the numerous flowering plants that grow in such areas are very attractive to butterflies. It is my purpose here to describe three such places that I have found to be very productive.

1. *Skookum Meadow.* Looking at a road map of Oregon, I became curious about the Walker Rim, a mountainous area in the Fremont National Forest just east of U. S. Highway 97 and about 50 miles south of Bend. A "rim" is the same as an escarpment, a steep slope caused by an ancient upthrust of the land. So I went up there. On top, the land levelled off toward the east, the soil was mostly pumice, making driving easy, but covered with a thick growth of Lodge-pole Pine, under which practically nothing grows. A worse place for butterflies can hardly be imagined.

But the Forest Service map had shown some meadows. So I pushed on. Suddenly, the trees opened up and here was a gem of a meadow, a half mile long and a couple of hundred yards wide, covered with flowers, and literally swarming with butterflies. I could hardly believe it.

Collecting in this meadow for less than three hours, I found I had 100 specimens, after discarding the poor ones, and they added up to 33 species. Commonest was *Phyciodes campestris* and it was a *pest*, at times being mistaken for something else. Then came *Euphydryas editha* and then *Cercyonis œtus*. Next to these in abundance I would put the *Speyeria*, and PAUL GREY has identified six species for me: *coronis* ssp., *zerene* near *conchyliatus, callippe* ssp., *egleis* unnamed ssp., *hydaspe,* and *mormonia,* the latter perhaps *erinna.* There were nine species of lycænids, the most interesting one being *Plebejus shasta.* Scarcest was *Danaus plexippus,* a single specimen of which was being

hustled and harried all over the meadow by a frantic and frazzled fritillary, which PAUL tells me is *S. callippe.*

There were a few clouds in the sky and when the sun got behind one of them the *Speyeria* disappeared. I soon found where they were, spread out flat on a barren sandbank facing the sun, soaking up as much heat as they could. As soon as the sun came out, back they went to the blossoms.

There was a very noticeable number of dwarfed specimens in this meadow — *Boloria, Euphydryas, Cercyonis, Phyciodes* and some of the lycænids. Could this be the result of not enough food or perhaps of inbreeding in this isolated place?

This meadow is not shown on the forest map, — it is too small. But I have named it Skookum Meadow, because it is just south of Skookum Butte, which is on the map, and because in the Chinook Indian language "skookum" means "mighty good." The elevation is 5200 feet. I collected here late in July and am curious to see what it will yield a month earlier.

2. *Satus Ski Area.* This is near Highway 97 also, but in Washington between Toppenish and Goldendale. It is part of the Brooks Memorial State Park. The latter is a few miles south of Satus Pass, but to get to the ski slope you must turn off the highway right at the pass and go west for a couple of miles.

A considerable area has been cleared and is now growing up to flowers, grass and low shrubs. The top of the slope is perhaps 500 feet higher than the bottom and the average elevation is about 3700 feet. Because range cattle sometimes graze the slope, it is not always good. But an area of seepage at the bottom is worth looking at, and *Speyeria* may be found in season on a patch of dogbane (*Apocynum*) just above the lodge.

Because time is important as well as place, this area does not yield much in June. But here, on a July day in 1960, I collected 30 species. Altho not as numerous as at Skookum Meadow, many were plentiful. Notable were five species of *Speyeria,* the same basic ones as at Skookum Meadow, except for *egleis,* but the subspecies were different; also *Euphydryas colon* and *editha, Chlosyne palla* (*whitneyi* and *sterope*), and *hoffmanni manchada,* all past their prime; nine species of lycænids; and *Œneis nevadensis.* DAN CARNEY took *Œn. chryxus* here a few days earlier, but I did not find it.

The great popularity of skiing has opened up slopes like this one in many places and collectors would do well to examine them. No skiers will crash into you while you are doing it.

3. *Bear Canyon.* West of Yakima, in Washington, the Tieton River comes down from Rimrock Lake and combines with the Naches River, both carrying the precious stored-up melted snow that makes the Yakima Valley so rich agriculturally. Collecting is not especially good along either river. But go 8 or 10 miles up the Tieton and if you look sharply, you will see a narrow forest road going into the hills to the right. This is an old logging road going up Bear Canyon, and maintained for access in case of fire. There is a small stream coming down the canyon, but the Forest Service refers to this as a canyon rather than a creek, probably because there are already two other Bear Creeks in Yakima County.

And this is a canyon, narrow, with steep sides, – in many places there is just room for the creek and the road. The sun shines down into it much of the day, there are a few small side ravines, and everywhere there are flowers,–asters, spiræa, pentstemon, *Eriogonum*, yarrow, *Erigeron*, mallow, *Mimulus, Senecio, Erysimum, Arnica,* lupines, and the little Woolly Sunflower (*Eriophyllum*) which is especially attractive to butterflies. Here, in a stretch of about three miles, with an average elevation of 2500 feet, is a butterfly paradise. Collecting is good from May to August. And here on a July day, Dr. A. I. Good, of Ohio, and I took what is so far a record for me – 36 species. They are worth listing:

Papilio eurymedon
P. rutulus
P. multicaudatus
Colias occidentalis
Pieris rapæ
P. protodice
P. beckeri
Cœnonympha tullia
Cercyonis pegala
C. sthenele
Speyeria cybele leto
S. callippe semivirida
S. coronis simætha
S. hydaspe sakuntala
Chlosyne palla
Phyciodes mylitta
P. campestris
Polygonia satyrus
Nymphalis antiopa
N. californica
Limenitis lorquini
Satyrium behrii
S. sæpium
S. californica
Strymon melinus
Lycæna heteronea
L. nivalis
L. helloides
Plebejus acmon
P. icarioides
Heliopetes ericetorum
Pholisora catullus
Erynnis persius
E. icelus
Hesperia juba
Ochlodes sylvanoides

In addition to these, 26 other species have been taken at other times in Bear Canyon. They are:

Parnassius smintheus	*Callophrys eryphon*
Papilio indra	*C. fotis*
P. zelicaon	*C. augustinus (iroides)*
Colias eurytheme	*C. spinetorum*
Anthocaris sara	*Plebejus melissa*
Euchloe ausonides	*Glaucopsyche lygdamus*
Neophasia menapia	*Everes amyntula*
Œneis nevadensis	*Celastrina argiolus*
Chlosyne hoffmanni	*Apodemia mormo*
Euphydryas colon	*Pyrgus communis*
E. editha	*Erynnis propertius*
Nymphalis cardui	*Thorybes pylades*
Polygonia zephyrus	*Amblyscirtes vialis*

Thus a total of at least 62 species occur in this small area, of the 100 so far found in Yakima County. Two species were especially abundant in June 1961. These were *Chlosyne hoffmanni* and *Lycæna nivalis. Heliopetes ericetorum* was numerous in 1960, the caterpillars feeding in the bush mallow, but scarce in 1961. *Papilio indra* and *multicaudata* are always scarce, and *Neophasia menapia* and *Apodemia mormo* were taken there for the first time in August 1961, altho I have been collecting in this canyon for four seasons.

There are many other good collecting places in the Northwest: – in Oregon, the Ochoco and Maury Mountains in Crook Country, Tombstone and Lost Prairies in Linn County, the resort area around Bachelor Butte in Deschutes County, Diamond Lake in Douglas County, and Summit Prairie east of Lakeview; in Washington, Mt. Spokane, O'Brien Creek near Republic, the Blue Mountains, some of the forest lookouts in Yakima County, many places in Okanogan County, and some western Washington places; in northern Idaho, the higher elevations in the Priest River Experiment Station in Bonner County, and of course many others. But the three described above have been the best. Forest Service people are always happy to help with suggestions, with advice about roads, and with maps of their forests.

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EDWIN PAUL MEINERS (1893-1960)

We regret to report the death on October 28, 1960 of the veteran entomologist and physician Dr. EDWIN PAUL MEINERS of St. Louis, Missouri. Dr. MEINERS was a Charter Member and long a Sustaining Member of the Lepidopterists' Society and contributed several articles to the pages of the *Lepidopterists' News* (see bibliography at the end

of this obituary). From early boyhood he was an ardent lepidopterist and continued this interest until his death.

Edwin Meiners was born in Troy, Illinois, on February 11, 1893. His grandfather emigrated to America in 1849 and came first to St. Louis, later locating in Troy, a small town of about 2000, where he remained for the rest of his life. He owned and operated the White Horse Tavern which became famous as a stopping place in the stage coach days when the old National Road was the main artery of travel between the East and the West. Edwin's father, Frederick Meiners, Jr., was born and raised in Troy and continued the family business which expanded into the Central Hotel. His mother was Eliza Pfaff and he was the oldest of five children born to William and Eliza Meiners. He is survived by three brothers.

In a detailed and careful autobiography and family genealogy which Edwin Meiners wrote a few years before his death, he says of his father: "His life exhibited very markedly the characteristics of the German as we are wont to think of him in the days when he was loved by all; non-aggressive, modest Hanoverian Teuton, a sincere lover of home and children and all the comforts of life as best summed up and expressed in the German "Gemütlichkeit". His devotion to his children was very deep. The days of my childhood that have left their deepest impression on my mind and character, that today remain the fondest of memories, were those spent in the company of my father. It was his guiding hand although untutored, that first pointed out the beauties of nature to me. It was he who aided me in the problems of gathering and preserving my natural history history specimens, who helped me in my work and play." I would like to say here that many of the endearing qualities which Dr. Meiners attributed to his father were also manifested in large measure by him. In addition there was a deep scholarliness and absolute integrity which caused me to recommend his services whenever a friend asked me for the name of an honest physician.

Dr. Meiners received his medical training in St. Louis and interned at St. Luke's Hospital. While still an intern he was the first to develop a method of injection of intravenous glucose to combat post-operative shock. Thereafter it became a regular procedure in the treatment of shock. In World War I he served in Nashville, Tennessee, with the United States Public Health Service. While at St. Luke's Hospital he met and married Lillian Mae McGimsey, who survives him. Children of this marriage are Dr. Edwin Paul Meiners, Jr., Dr. Theodore M. Meiners, and Mrs. Mary Elizabeth Boughnou. There are twelve grandchildren living.

EDWIN MEINERS always felt keenly that St. Louis, whose metropolitan area has a population well over one million, could and should support a genuine natural history museum comparable to those in other large cities of the country, where the student could go to consult study collections and carry on biological research. It was his great ambition to see this established, but he died without seeing his dream realized. This was his great disappointment. In his efforts to arouse support for a museum he was a member of several embryo scientific clubs and of societies in St. Louis, some of which had brief histories: the Heink Entomological Club, the St. Louis Entomological Club, the Webster Groves Nature Study Society, the Greater St. Louis Museum of Natural History, the St. Louis Naturalists' Club. and the Academy of Science of St. Louis. He was one of the organizers in 1934 of the Entomology Section of the Academy, which flourished for about ten years. Members of this section, many of whom have since published significent contributions on entomology were: O. ZIELINSKI, RICHARD FROESCHNER, L. PINKUS, E. D. BUEKER, WENDELL SHAY, HUGO PRESS, MARTIN GORDON, HAROLD O'BYRNE, PHIL RAU, P. S. and C. L. REMINGTON. Writing of these meetings MEINERS says: "One night SHAY electrified us by appearing rather late loaded down with a two foot long setting board and two quart jars filled with the most wonderful moths. He not only took our breath, but he broke up our meeting by offering to take those of us with him who were willing to go at this hour of the night and to share his discovery with him." Dr. MEINERS was chairman of this section at different times. He also served the Academy as Curator, Librarian, Second Vice-president, Editor of the *Bulletin*, member of the Board of Directors. At one time a gift to the Academy gave it a very large brick residence, in a fine area of the city, which was turned into a museum. Dr. MEINERS organized and arranged the first insect exhibits, using much of his own collection. However, this effort eventually died out and the museum now maintained by the Academy is virtually a Childrens' Museum. Dr. MEINERS felt that this was not the proper place for study collections and so he willed his fine collection of insects to the University of Missouri. It is now under the care of Dr. WILBUR ENNS, who tells me that the collection consists of 330 boxes and drawers of Lepidoptera, 96 of Coleoptera, 13 of Hymenoptera, 15 of Orthoptera, and 38 of miscellaneous groups. A conservative estimate places the number of specimens at a total of 30,000 to 40,000. The collection is now in the Entomology Museum at the University of Missouri.

In recent years Dr. MEINERS developed an interest in other branches of entomology besides Lepidoptera and made a good general collection

of the insects of Missouri as shown by the above items. His favorite collecting haunts around St. Louis were Cliff Cave, Creve Coeur Lake, and especially Ranken, about which he wrote a fine article (*Lepid. news* 10: 163). He was greatly interested in the history of science and prepared excellent papers on outstanding Missouri entomologists. He collected all the published papers of CHARLES V. RILEY, first State Entomologist of Missouri, and of MARY V. MURTFELDT, an early lepidopterist of Kirkwood. He owned a collection of letters and writings of early and contemporary entomologists and a notable collection of rare books on entomology. This was purchased by the General Library of the University of Missouri. Part of the purchase price was used by his widow to establish the Dr. E. P. Meiners Memorial Scholarship fund at the University. Mrs. MEINERS tells me that the Doctor was working at the time of his death on a book to be entitled "The Effect of Insects on Civilization." An effort will be made to ascertain if some of the material in it can be published.

Dr. MEINERS was regarded as an authority on medical entomology. He was certainly the dean of entomologists in St. Louis. His first love was always Lepidoptera. He was always willing to present interesting and scholarly papers on topics connected with butterflies and other insects. He wrote: "I spent about four hours one Sunday afternoon showing my collection and lecturing on entomology to a class of students from Harris Teachers College. I doubt whether any of the class had ever sat through a lecture that long!" He well recognized the importance of encouraging young people in the study of insects and several of the young men to whom he gave encouragement are now professional entomologists, including the Editor of this publication.

He was a member of the American and Missouri Medical Societies, the Entomological Society of America and the American Association for the Advancement of Science. Just before he died he was instrumental in the starting of a new entomological society in St. Louis. Plans for this were continued after his death and the society took in his honor the name of The E. P. Meiners Entomological Society. The society has held monthly meetings under the chairmanship of Mr. PINKUS and is thriving.

Dr. MEINERS will be remembered by his many friends for his unfailing kind efforts to help even the layman gain some understanding of entomology and to show them his collection and encourage them to learn of the wonderful world of insects. He tried to give them an appreciation for the truly scientific viewpoint toward all matters biological. His name may be found in DOS PASSOS' forthcoming Check List

of the Nearctic Rhopalocera, for GUNDER named an aberration of *Strymon melinus* and FIELD named the spring form of *Everes comyntas* for him. Dr. MEINERS was not particularly proud of this, for he held that aberrations and forms should not be named. Indeed, he long felt that there were too many species names and believed that when the biology of Lepidoptera is better understood, many names will disappear into the synonomy.

Many pleasant evenings were spent by this writer in Dr. MEINERS' study or in mine as we chatted about insects. On one occasion I recall saying to him a little facetiously: "Doctor, you know the world thinks you and I are "nuts" to devote so much time and effort to collecting and studying bugs!" He replied, without the familiar twinkle in his eye: "Mr. REMINGTON, what the world is more "nuts" like you and me! There would be a lot less tension and trouble in the world if this were so."

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RECENT LITERATURE ON LEPIDOPTERA

(Under the supervision of PETER F. BELLINGER)

Under this heading are included abstracts of papers and books of interest to lepidopterists. The world's literature is searched systematically, and it is intended that every work on Lepidptera published after 1946 will be noticed here; omissions of papers more than 3 or 4 years old should be called to Dr. BELLINGER's attention. New genera and higher categories are shown in CAPITALS, new species and subspecies are noted, with type localities if given in print. Larval foodplants are usually listed. Critical comments by abstractors may be made. Papers of only local interest and papers from this *Journal* are listed without abstract. Readers, not in North America, interested in assisting with this very large task, are invited to write Dr. BELLINGER (Dept. of Natural Sciences, San Fernando Valley State College, Northridge, Calif., U. S. A.). Abstractors' initials are as follows:

[P.B.] – P. F. BELLINGER	[W.H.] – W. HACKMAN	[N.O.] – N. S. OBRAZTSOV
[I.C.] – I. F. B. COMMON	[T.I.] – TARO IWASE	[C.R.] – C. L. REMINGTON
[W.C.] – W. C. COOK	[J.M.] – J. MOUCHA	[J.T.] – J. W. TILDEN
[A.D.] – A. DIAKONOFF	[E.M.] – E. G. MUNROE	[P.V.] – P. E. L. VIETTE

B. SYSTEMATICS AND NOMENCLATURE

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Marion, H., "Révision des Pyraustidæ de la faune française" [in French]. *Rev. franç. Lépid.,* vol.14: pp.123-128, 1 pl; pp.181-188, 221-227, 16 figs.; vol.15: pp.41-58, 24 figs. 1954-55. Revision of the Pyraustidæ of the French fauna. The author begins with long comments on the history of the classification, the taxonomic categories and the morphological structures. The group of pyralids is divided by Marion into: Crambidæ, Pyraustidæ, Acentropidæ, Pyralidæ, Phycitidæ, and Galleriidæ. The subfamilies of the Pyraustidæ are Scopariinæ, Nymphulinæ, Schœnobiinæ, Pyraustinæ, Evergestinæ. The author starts with the Acentropidæ; Schœnobiinæ and Scopariinæ (with two tribes: Scopariini and Cybalomiini) follow. Keys for families, subfamilies, tribes, genera, and species are given. Study to continue. [P. V.]

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Journal of
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NOTES ON OVERLAPPING SUBSPECIES. I. AN EXAMPLE IN *SPEYERIA ZERENE* (NYMPHALIDÆ)

by L. P. Grey and A. H. Moeck

During the 1959 and 1960 seasons Moeck collected series of *Speyeria zerene* (Boisduval) in and near the Warner Mountains, Modoc County, California, demonstrating a geographical overlap of two radically different subspecies and thus reinforcing a hypothesis of relationship hitherto deduced more indirectly.

For background, illustrative material appended includes a resume (table 1) of subspeciation accredited to *zerene*, and a chart (map 1) indicating geographical distribution of the subspecific characters; these should enable orientation of the forms to be discussed herein. Topography of the particular areas mentioned is shown by map 2; specimens selected to depict normal and extreme variation in spot localities are illustrated in figures 1 and 2. The field notes on these series will be found appended, in a concluding section.

Figure 1 is of a series of males (in ventral aspect) from an unnamed ridge about 16 miles east of Eagleville, California, lying in Washoe County, Nevada. Normal variation in that locality is represented in rows 2 and 3 of figure 1, and is referable to the subspecies of *zerene* termed *cynna*. [*Note*: names considered lower-than-species are used throughout as catchwords; extent of blending discourages formal categorical applications.]

In a population of this sort, the upper singleton in figure 1 is remarkably abnormal, as would be more evident if seen in full color; it has well-developed ruddiness. The lower singleton has a reddish tinge; the specimens immediately above it (row 4) are largely unsilvered. Redness,

and lack of silver—these are characters unheard-of in *cynna* throughout the large area which that subspecies preempts in central and northern Nevada, in southern Idaho and southeastern Oregon. These two particular characters are, however, quite the normal thing in another *zerene* subspecies occurring just across the street, so to speak, from this Nevada colony.

Turning to figure 2, the three examples in the bottom row (M, N, O) will convey a good idea of normal *zerene* variation in the nearby Warner Mountains, i.e., running a bit darker but otherwise quite like the nominotypical Sierran forms. The remainder of the series in figure 2, namely, the sixteen specimens A through L in the four upper rows, are from the Patterson Meadows, at the southern end of the Warners in the southeastern corner of Modoc County. All were taken within less than a two-mile radius in substantially identical ecology and at about the same elevations (7300-7500 ft.).

Typical *zerene* predominated (samples G, H, I, L) but *cynna* also was procured here (samples A, B, J, K). Some individuals were strikingly intermediate (samples C, D, E, F) and all the more interesting since two (D, E) were in a "congregation of *cynnas*" and one (F) was in association with *zerene*. The greatest extremes (J and L) were netted from the same flower bed although in different years.

Attempts to secure large samplings were unsuccessful, being hampered by the aridity and lack of roads. The Patterson Meadows locality is the only one as yet discovered along the east rim of the Warners where this blending is widespread and obvious although occasional singleton intermediates have been taken in those mountains. Closer search was clued and encouraged by the gene recombinations noticed in the Washoe County series.

The rough balance of segregation vis-à-vis blending occurring in the vicinity of Patterson Meadows lends credence to a rather commonly held hypothesis, which is that the colonial and individual "pale *zerene*" turning up along the Sierran-Basin tension zone (the *malcolmi* near the Mammoth Lakes, the mixtures in the Tahoe passes, etc.) are resultants from contacts between the red Sierran and the yellow Great Basin forms. The relationships originally were deduced from cumulative gene replacements observable around a two-thousand-mile horseshoe (Moeck, 1957); present records serve to confirm opinions of the phylogeny as based on directions taken by variation in geographically arranged material. The extreme divergence of the end-products discouraged hope of ever finding intermediates; the segregation accompanying the blending is not at all surprising.

Fig. 1: Samples of S. *zerene* ssp. from Washoe Co., Nev. See locality on map 2, data in record section, comments in text.

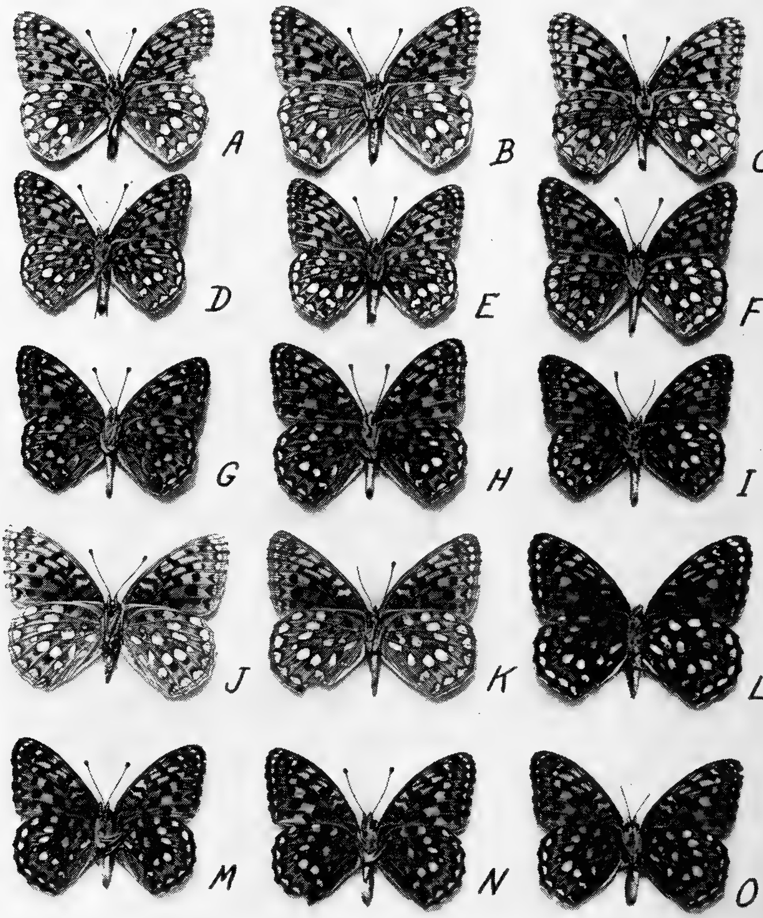
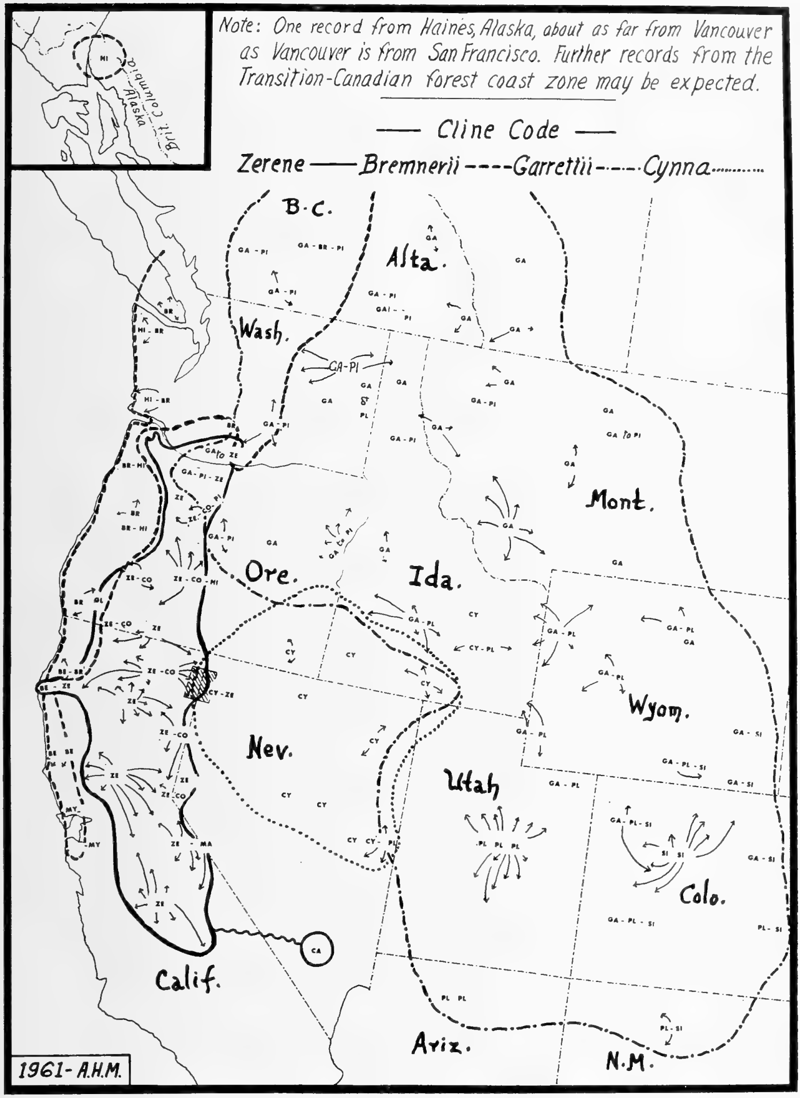


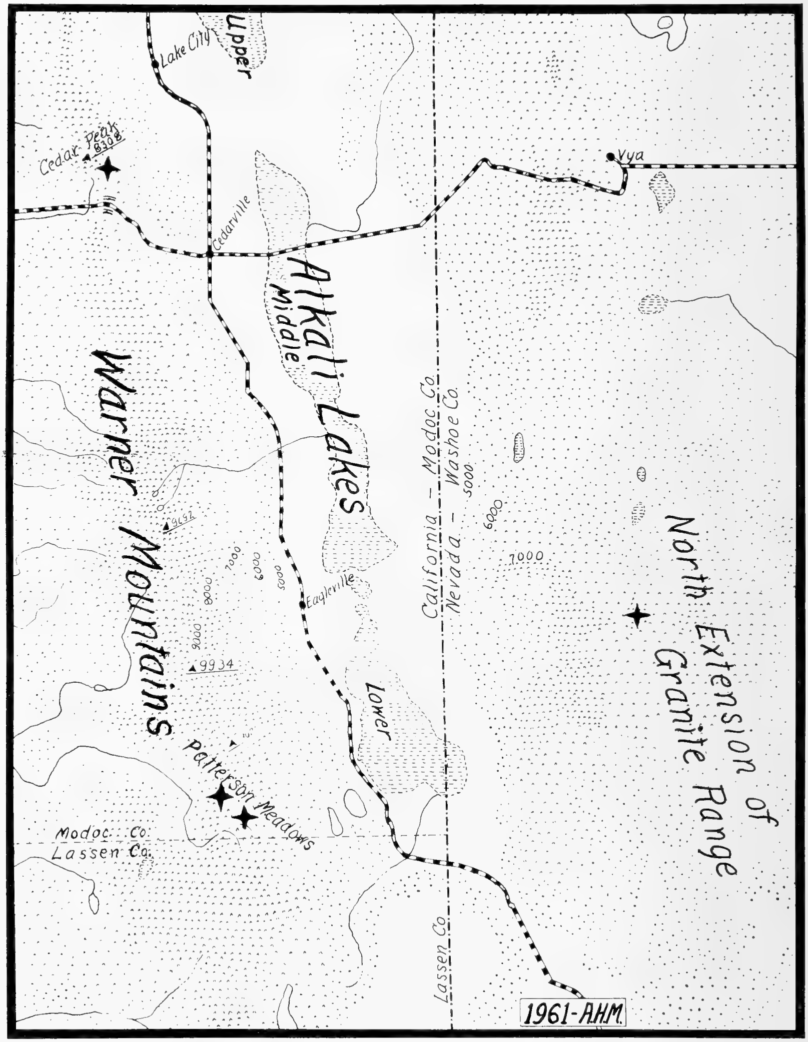
Fig. 2: Samples of S. *zerene* ssp. from Modoc Co., Calif. See localities on map 2, data in record section, comments in text.



Map 1: Distribution of S. *zerene*. See table 1 for key to symbols. The shaded rectangle denotes area shown in map 2.

Discussion

Mention of other geographically correlated peculiarities of *zerene* seems due, but is abbreviated because of a desire to expand some remarks on problems at which this and succeeding articles are aimed.



Map 2: Topography of a section of Modoc Co., Calif., and Washoe Co., Nev., where S. *zerene* ssp. illustrated in figs. 1 & 2 were taken. See record section and text comments.

For that matter, students familiar with Western topography and with *zerene* probably will find all of their observations and conjectures implicit on map 1. Appearing there, for examples, are (1) the gross correlations of the four large divergencies with the four physiographic provinces; (2) the zones of stability and instability – accordingly as clines converge or overlap, and with individual variation lessening

toward the middle and south portions of each province; (3) the hints of refugia, viz: (*a*) that the Coast Range set is incongruously largely divergent, possibly from an earlier archipelago, (*b*) that *platina* likely is nearest to the earlier "heartland" interior form, *garretti* a recent offspring wave northerly, *sinope* a Wyoming Basin isolate, *cynna* a relatively undisturbed Snake River Plateau resident, (*c*) that the southern distribution (as always) is the most obscure–is *carolæ* a relict, parent to Sierran forms, or a recent emigrant therefrom? — and why the hiatus in the Greenhorns and Tehachapi, the rarity in the Plateau country? — this insect demonstrates successes and tolerations to warrant some expectations which are disappointed southerly, so the failures probably have special significence; (4) the area of greatest plasticity, in the Pacific Northwest, as is inevitably predicted by the cornering of the four zones in that region and from the ideas of glacial retreat which indicate a recency of the contacts. Now, to the Modoc-Washoe County material: this, almost surely, exemplifies *intraphyletic segregation.*

Herein, and in following papers, the writers will point to instances, mostly in *Speyeria,* of apparent partial or total segregations occurring within the distributions of varieties presumed related to the extent of belonging to single phyletic lines — or, if defined in a quibbling spirit, belonging within a single "species" as best that category can be applied with present knowledge. Overlaps of this nature are engaging attention of researchers in a number of fields of evolutionary inquiry, for it is believed that such collisions of isolates are likely to provide rich data for genetical, cytological, paleogeographical and other studies.

Questions raised by these occurrences seem almost endless; some will be noted in later papers; in this discussion attention is drawn to three aspects, to wit: (1) the taxonomic, (2) the geographical (correlations with environment and barriers) and (3) the paleogeographical — which belongs closely bracketed with (2) because of uncertainties as to when the divergencies within population structures have been acquired.

Notations of overlaps such as these are obligations falling largely on taxonomists. It is they who presume to name and index species, from which listings the studies of evolution take their directions. Some of the conceptual modifications brought on by discoveries of taxonomists (*e.g.*, intraphyletic segregations — wherein species fragments differ to the extent of appearing locally discrete, and siblings — wherein convergence is uppermost, so that specific distinctness may be thoroughly masked, lying more in biology and behavior than in facies) obviously have affected evolutionary thinking. It is quite certain that more local anomalies of such caliber remain to be discovered, and that existing classifications will

Table 1. POPULATION STRUCTURE OF *SPEYERIA ZERENE.*

(On map 1, geographical areas of segregation and blending of these tabulated characters are shown by index symbols denoting the clines and subspecies as listed below).

Symbol	Name	Characters	Distribution
	CLINE 1	DARK RUDDY ABOVE, DULL BRICK DISK, SORDID BAND	SIERRA NEVADA, SOUTHERN CASCADES
ZE	*zerene*	silvering becoming absent southerly	South to Middle Sierra Nevada
CO	*conchyliatus*	silvering & melanism increasing northerly, laps into clines 2 & 3	Northern Sierra, Southern Cascades
MA	*malcolmi*	paler, lighter band, mostly silvered, intergrades toward cline 4	East Slope Sierra, Mammoth L.-L. Tahoe
CA	*carolæ*	ruddy, but with yellowish cast, dull silver & band, an outlying isolate	Charleston Range in Southern Nevada
	CLINE 2	RUDDY ABOVE, RED DISK, CONSPICUOUS YELLOW BAND, INVARIABLE SILVER	PACIFIC COAST RANGES
BR	*bremnerii*	heavy dark pattern above, basal suffusion, limbal area lighter	Puget - Willamette Trough, Ore. to B. C.
HI	*hippolyta*	small than *bremnerii* but similar in other respects	near the ocean, Ore. to Alaska
GL	*gloriosa*	intergrading from *bremnerii* to cline 1	interior coastal slope of so. Ore.

BE	*behrensii*	lessened basal suffusion, browner disk, intergrading to cline 1	No. Calif. coast, Mendocino Co., etc.
MY	*myrtleæ*	light ground, deep basal suffusion, a southermost coastal divergence	Middle Calif. coast, Marin Co., etc.
	CLINE 3	BROWNISH ABOVE, SILVER INVARIABLE, DISK SOME SHADE OF BROWN	NORTHERN CASCADES, ROCKY MOUNTAINS
PI	*picta*	disk tending reddish, intergrading to cline 2	E. Slope No. Cascades & toward Rockies
GA	*garretti*	brownish disk with some white flecking, narrowed band, good-sized	No. & Middle Rocky Mts. foothills
PL	*platina*	tending smaller, paler, wider band, intergrading to cline 4	Plateau, Basin, & edging the Rockies
SI	*sinope*	still smaller, sharpened pattern, brown to greenish disk	N. W. Colorado & S. E. Wyoming
	CLINE 4	REMARKABLY PALLID, PALE BUFF DISK NOT MUCH DARKER THAN YELLOW BAND	UPPER GT. BASIN, SNAKE R. PLATEAU
CY	*cynna*	silver invariable, intergrades to clines 1 & 3	No. Nev., So. Ida., N. E. Calif., S. E. Ore.

Notes: Available names ignored include (1) *sordida*: type locality questionable, hence useless as symbol of known local variation; (2) *pfoutsi*: needlessly fine splitting due to GUNDER's erroneous identification of *platina;* (3 & 4) *shastaensis* and *sineargentatus* represent aberrant individuals, not populations. Recognition of *cynna* as coequal with other regional groups follows from an assumption that it is descendent from a similarly major isolation. *N.B.*: the *myrtleæ* mapped below San Francisco Bay now is presumed extinct.

be set up by them. Evolutionary conceptions draw their warrants from the prevailing editions of "species"; taxonomy provides the impetus.

The *cynna - zerene* overlap falls within boundaries of credibility as established in the 1945 dos Passos and Grey catalogue of *Speyeria,* wherein *cynna* is listed as a subspecies of *zerene.* A regrettable error in that index is corrected hereby: the *carolæ* population in southern Nevada pretty surely belongs within *zerene* and not under *coronis* (Behr) where it was described originally.

Present taxonomic worries therefore seem unnecessary, except as all such relegations have to continue passing the yearly tests of new discoveries and changing concepts. The *Speyeria* classification mentioned was framed deliberately to reduce species to the utter minimum allowable against sympatrisms, allopatrisms and intergradings as then known. Future revisions probably will be more of concept than of groupings: it will appear that those who have catalogued *Limenitis,* for one example, make more species than the present speyerian philosophy would admit, and so it goes; in various genera some will lump, while others, familiar with the same data, will claim that lumping is not the best answer.

Some valuable taxonomic moralizings probably can be drawn from study of intraphyletic segregations within *Speyeria;* the situations described assuredly will be found duplicated, substituting places and species, in genera such as *Papilio, Euphydryas, Cercyonis,* etc., which seem now on the verge of long-awaited syntheses. It may be helpful to emphasize, as is the intention, that overlaps can be obscure in many ways and in sophisticated fashions, almost sure to be overlooked unless the fund of distributional knowledge is at once broad and detailed. Some hybrid zones shout their presence and are matters of common knowledge, as in Northeastern *Limenitis* and *Colias* — even then they may baffle taxonomists intent on pouring all of the new wine into the old skins of Linnaean concepts — but others may be entirely unsuspected because with data as skimpy as ordinarily is available the early stage of hypothesis would have to be made in defiance of the very cornerstone tenets of the species-makers, for these reasons:

The usual picture of subspecies is of geographically oriented divergencies which blend with other intraspecific forms along sharp or ill-defined boundary lines. But divergence in plastic genera can be extreme to the point of incredibility. Intergradings which would clue relationships may be slightly or not at all in evidence, perhaps confined to poorly explored areas or even lost by extinction. What, then, if two great extremes work into contact? Local samplings are likely to come up with two very different forms, each apparently discrete. By con-

ventional standards these indeed are species. Local naturalists must be allowed their word of truth: sympatry plus evident biogenetic differentiation spells out "species" quite positively. But students of population structures also have a right to be heard: if locally discrete sympatres display a gradual convergence when traced geographically into other regions, ending in an area or areas where blending is conspicuous or total, then a phyletic wholeness is manifested, which it is incorrect to claim for any of the parts.

Arguments and rebuttals of this sort will be heard increasingly as distributions are studied more intensively. Even now, the quirks of speciation and subspeciation known in butterflies compare favorably with those recorded for other groups of animals, and they will be scanned even closer in the future by students of evolution. Systematic taxonomy of butterflies therefore is in need of continued scrutiny; there are new frontiers; they lie, however, where they always have, *i.e.*, with segregations and overlaps. The concepts and tools need refining to deal with complexity hitherto suspected and now being confirmed.

A second arresting feature of intraphyletic overlaps, in addition to their challenges to taxonomy, are their morphological dissimilarities which so obviously flaunt the hypotheses built around ideas of variation responding to local ecogeographies. There has been a great deal of research along the latter lines, prompted by convergencies and parallels seen not only within closely related genera but also among forms known to be well apart phyletically. As an example of explanations which have been sought in particular factors of a shared environment the work by Hovanitz (1941) is a classic of its kind.

Parallels within *Speyeria*, as noted by Hovanitz, lend themselves irresistably to evolutionary speculations, being numerous to the point of endlessness, often involving very different species (and thus throwing heavier burdens on taxonomists quite sufficiently beset with anatomical likenesses and ecological overlaps). Hovanitz's correlations of melanism with insolation stand unanswerable. He makes no further special claim that environment has the paramount role in determining variation, as some others have done with less excuse, or have so implied by pointing out the many geographically correlated parallels in various genera.

Recently (1959), Van Someren and Jackson have summarized some ways in which parallels are supposed to evolve consequent from various kinds of mimicry, including *arithmetic mimicry* which certainly ought to apply in *Speyeria* to the advantage of locally scarce species; in these cases the convergence results from a "dwelling together" but has nothing directly to do with geography.

Such theories have the attraction of offering plausible rationalizations of wide applicability. They have a drawback of seeming to finalize "causes" which almost surely are incredibly multi-factorial however plainly one element may appear to stand out.

Dissimilarities evidenced in intraphyletic segregations give salutary check to environmental postulates. For example, *cynna* and *zerene* are at the very antipodes in coloration, and yet they face one another in similar ecologies across narrow barriers – and now turn out to fly in the same meadow. In such instances, it may be inferred that properties which are intrinsic (incompatabilities based in physiology) outweigh all extrinsic things such as geographical propinquity and identity of ecological background.

In a later paper attention will be directed to a segregation which really may have resulted in large part from differential adaptability to micro-environmental factors, as perhaps can be found upon close analysis in the other overlaps of isolates. Still and all, it hardly seems tenable to suppose that segregations such as in Appalachian *Limenitis* can be explained as being due to any sharp breaks in climate or ecology. There, and most likely in the great majority of overlaps, the better rationalizations seem to lie with genetics, with time, and with paleogeography.

The time element undoubtedly is the great enigma underlying the questions with which evolutionarily oriented taxonomy grapples. How long does it take, what particulars of environment are needed to cause species to diverge? Once established, how stable then are the gene systems thus integrated harmoniously to place, time and species? As the years bring changes, as populations migrate with climates, and as balances are struck between selection pressures and mutation rates, what then does local variation reflect of immediate situation and of earlier history?

A sharp dichotomy runs through the whole literature and theory of evolution: On the one hand, a multiplicity of "causes" are adduced which logically ought to lead only to chaos, the supposed mechanisms and modifiers being varied and acting at random; on the other hand, the natural order reflects crystallization into definite patterns down to such trivialities as that certain subspecies of butterflies occupy territory to the exclusion of others. Can it be that the "causes" by their very infinity give statistical expectation of orderliness in resultants, as in the modern "laws" of physics?

This touch of paradox is delightfully exposed in FORD's (1954) *Butterflies,* where mention is made of a strain of *Euphydryas* which was observed to subspeciate markedly in less than three decades–followed

later by a chapter discussing Pleistocene population movements as deduced (how else?) from present distribution of wing characters!

Observed population structures lend themselves to just such contradictory speculations, being (1) easily upset by outbreeding, population fluctuation or applied experiments, but at the same time (2) appearing in the wild state as geographically well-entrenched in respect to subspeciation, so that some form of selective elimination has to be postulated as operating to choke off blending observed to go on in contact areas.

It is easy, then, to deduce that variation is a reed in the wind, a pliant hostage to circumstance. But there is even more reason to postulate a really massive inertia inherent in population dynamics, as becomes almost a necessity when thinking over the history of systematic taxonomy. For example, as soon as continental glaciation moved up from theory to accepted fact, the large changes needed to incorporate arctic relicts on temperate-zone mountains were made without much argument, since affinities, when looked for, had remained very little obscured by those large isolations. In these and in similar instances taxonomists have had some conspicuous successes in equating classifications with earlier refugia and barriers, hence the growing tendency to suppose that paleogeography may be deduced in part from observed distributions, a hypothesis justifiable only if the rate of evolutionary change is quite slow.

In this connection, it is instructive to run through the data used by HOVANITZ in support of ecogeographic correlations: the idea of population movements and confinements underlying the observed regularities seems to appear equally valid; in fact, he was among the first to realize that local variation in *Speyeria* generally is predictable from surrounding character distributions. There is, then, no essential contradiction in the fact of intraphyletic segregates being so unlike although sympatric — these become comparisons in quite another dimension, namely, the one of time. The obvious correction is to allow for earlier isolations, granting that local effects of climates at best are a superimposition upon accumulated past heritage.

The present authors believe that intraphyletic segregations have their greatest interest in this suggestion that they probably are true signboards pointing to earlier isolations. If taxonomists succeed finally in defining species they will be in the same position as the pup that caught the locomotive: what to do with it? If it could be assured that wild populations tend to be reasonably stable in time — a proposition often taken for granted but by no means easy to prove — a fresh world

would open up for inquiry and distributional data could become a key unlocking new wonders.

Specialists in most groups already are convinced that morphology and biology provide insufficient criteria of specific discreteness and that some reckonings must be taken of paleogeography. The present authors will go so far as to suggest that degrees of divergency may be interpreted as providing fairly good indices of the degrees of isolation undergone by phyletic segregates. This would grant to evolutionary processes an evenness and inevitability not at all defensible, and to wing variation a long-term stability hardly in keeping with experience. It is seen, however, that *Speyeria* population structures fit with present ecogeographies in most details of clinality, but then show in zones of overlap degrees of segregation which accord roughly with estimates of earlier barriers and time scale, "as if" divergence were a function of time.

An example in the species *atlantis* (Edwards), typical of the untapped riches in *Speyeria,* demonstrates how overlaps can carry seemingly reliable indication of the durability of subspecies in time. An abstract follows:

An unusually ruddy and melanic population of *atlantis* occurs in the aridly isolated Stansbury Range, near the eastern side of the Great Basin in Tooele County, Utah. A very different (more pallid) *atlantis* occurs in line of sight, in the Wasatch Range, thus almost exactly paralleling the *zerene* - *cynna* confrontation. In this latter case, when the wing color characters peripheral to these colonies are mapped, and when the recent water and ice configurations (which here happen to be rather well known) are reconstructed, the character correlations all are with the late glacial geography and otherwise are worse than meaningless — the most like forms today are separated by the most tremendous barriers and the most unlike forms are in closest contiguity. The "small" barriers here are unusually formidable, so the argument can be made that sheer miles have nothing to do with the case — in fact, many people seem to think that divergence in isolated colonies such as are in the Stansburys is all a matter of local option and chance. Against this, the bulk of Great Basin distributions are roughly homogeneous despite scores or hundreds of dry valley barriers as severe as the ones between the Stansburys and the Wasatch Range; specialists note similar large regularities in population structures which hardly are in keeping with the idea of random subspeciation; the exceptions generally may be suspected of carrying special meanings, as in the presently cited instance where the integrating considerations clearly lie in paleogeography.

Very few distributions can be analysed as closely as would be possible with these colonies, to show that the Wasatch (recent intrusion) and the Stansbury (relict) populations are from different refugia. Present similarities of environment patently have not softened these divergencies; intermediates, such as occur, are found mostly in territories edging the foci of divergence, hence appear due to gene exchange through straying.

Surrounding variation gains rationality from the refugia suggested by this distribution. Students have only to look at a topographic map and subtract a few thousand years — then they will see grasslands and forests arising around the western rim of old Lake Bonneville, extending up through the "antelope country" of southern Idaho, and will see mountain glaciers creeping back over the Wasatch-Uinta highlands. The facies of the northerly *"tetonia"* then stands illuminated by the Stansbury discovery; the southwestern affinities of *"wasatchia"* then can be related to its recent entrance into a previously inhospitable upland; the present segregation then is unusually good evidence that the ephemera of wing colors are not to be shrugged off as local products of recent environments.

An example from another genus: *Lycæna "claytoni"* on shrub *Potentilla* in old fields, vicinity of Springfield, Maine, is widely different from *L. "dospassosi"* on a small prostrate cinquefoil in a salt marsh at Bathhurst, New Brunswick. Airline separation is about 300 miles, topographic barrier nil, ecologic barrier complete since neither foodplant is known from the intervening country. The Maine colony falls in a series having like facies and habits, distributed through Quebec and Ontario to Wisconsin and Michigan. The Bathhurst colony alone is anomalous. If specialists are correct in regarding all of these as biological radiates of a single phyletic line (the *dorcas - helloides* set), how is this distribution to be rationalized?

Nothing the simplicity gained by mapping the Maine-Michigan series as an outflow from a Mississippi Valley refuge, the incongruity of *"dospassosi"* then will recall that botanists and others report analogously queer isolates in and near the St. Lawrence Valley. The hints are of a separate East Coast (Grand Banks?) glacial refuge. This *Lycæna* segregation then would align with the idea herein stressed that such juxtapositions probably have their best explanations in paleogeography.

A fairly coherent synthesis of *Speyeria* can be achieved through this philosophy of regarding divergence as a function of geography and time. The practical aspects seem inexhaustable: good results continue to follow from adopting the catchphrase that geography can be trusted to produce specimens to order, and conversely, that specimens will reveal

geography, as would be demanded if equating present variation with paleogeographic refugia, for unless wing characters demonstrate (1) sensitivity to geography and (2) stability during local isolations, paleogeographic speculations would lack the necessary correlation with reality. These somewhat contradictory demands seem to be met by observed subspeciations: the degrees of segregation and blending usually accord with the constructions of landscapes and time.

As an example of specimens revealing geography, Mr. STERLING MATTOON (*in litt.*) recently found Lower Cascade - Sierran characters in a Coast Range colony of *zerene*, near Ferndale, Humboldt County, California. Upon inquiry as to possible ecological linkages which might rationalize this otherwise incongruous blending, he states that a yellow pine forest, a suitably indicative continuum, may be traced from near the coast here, following valleys into the Trinity - Shasta uplands.

As to the possibility of invoking geography to produce specimens, MOECK's explorations in the area shown on map 2 were centered there deliberately and with some expectation of finding mixed populations. A far cry, this, from the day when a red speyerian in a yellow population would have been one more incomprehensibility to place at the door of Chaos, this bee-line to a place designated, to search for the unknown postulated in advance!

It is no credit to the occult powers of specialists that they often seem to know where to look for particular character combinations; rather, it is a matter of projecting known population structure on a known landscape and then interpolating resultants. The credit obviously belongs to some large invariability in nature, which the present authors believe to be the degree of population stability required when postulating correlations with paleogeography. If more assurance is needed, the best things to regard are the impossibilities and contradictions arising when trying to correlate intraphyletic segregations with present environments.

Further illustrations, of commonplace and unusual variation equated to the theme of divergence harmonious with present and assumed past isolations, will be given in subsequent papers. It may be difficult to promote the idea that the supposedly unstable wing characters should have evolved in a fashion apparently providing *an analogue to the wanderings of the insects.* This, however, seems to be safer to defend, looking to samples of wild populations, than alternative propositions such as would associate subspeciations either with particular causes or with no causes at all; the fear that variation is mainly at random is wearing away, while older theories of adaptation to local climates are meeting increased questioning.

Records

[Map 1 was collated from records of approximately 3,000 specimens of *zerene*, abstracted from the senior author's card file of *Speyeria*. Students needing distributional data are welcome to borrow from these indexed records and are urged to contribute to their expansion.]

The specimens illustrated in figures 1 and 2, taken in the area shown on map 2, are out of batches with field notes as follow:

NEVADA: WASHOE CO.: "59BP": app. 16 mi. E. of Eagleville, Calif., in a patch of greenery on an unnamed, barren, dry rocky ridge (No. Granite Range outlier?), 7500 ft. elev., across the alkali lake from the Warner Mts., 17.vii.59 (*leg.* Moeck), 32 males near *cynna*, in good condition. The series includes 1 very red and 2 nearly unsilvered individuals. "59BQ": same place and date as 59BP but at 6800 ft. on barren rocks, 1 male *cynna*, a stray from the 7500 ft. elev.

CALIFORNIA: MODOC CO.: "60BD": E. side of Cedar Peak, N. of Cedar Pass, Warner Mts., 6500-7500 ft. elev., dry logging road through lightly forested hills, 22.vii.60 (*leg.* Moeck), 6 males, silvered and unsilvered, near Sierran *zerene*. "59BR": Patterson Meadows, app. 16 mi. S. W. of Eagleville, 7300 ft. elev. in brushy clearings along a creek, 17.vii.59 (*leg.* Moeck), 2 males, 1 female near *cynna*. "60BB": same place as 59BR, 21.vii.60 (*leg.* Moeck), 4 males and 1 female *zerene* ssp., the female brightly silvered, very red, the males from dull red to nearly as pale as *cynna*. "60BC": Middle Fork Spring of East Creek, about 2 mi. S. E. of Patterson Meadows in similar ecology along a creek, 7500 ft. elev., 21.vii.60 (*leg.* Moeck), 4 males and 1 female *zerene* ssp., 2 males red, remainder intermediate to *cynna*. Deposition: Collection of the junior author.

Acknowledgments

Photographs (figs.1 & 2) were taken by Kenneth MacArthur, using the facilities of the Milwaukee Museum. Kindly criticism and encouragement was received from Dr. C. L. Remington.

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A MOSAIC MELANIC MALE OF *PAPILIO GLAUCUS*

J. A. Ebner reported a melanic male of *Papilio glaucus canadensis* Rothschild & Jordan in the March, 1961, issue of this *Journal.* Another melanic male of this subspecies was caught by E. M. S. on June 27, 1961, on Gorge Creek where it is crossed by Highway 11 north of Nipigon, Ontario. The specimen settled down amidst a score of normal males on a wet spot of the sandy bank of the creek. It was at once recognized as a melanic mutation and easily netted. It is a perfect specimen much resembling in general distribution of the black scales the specimen figured in the issue quoted above.

Papilio glaucus canadensis ♂, upper surface at left, lower surface at right. The bilateral asymmetry is conspicuous, the left wings being much more heavily blackened than the right wings.

However, the striking difference between the more heavily melanic left wings, on the upper as well as under side, characterize this specimen as a bilateral genetic mosaic. An explanation for the exact mechanism of its formation can not of course be given, without breeding work. The chromosome or part of it carrying a modifier for one of the several (?) genes responsible for melanism could have been lost during this mitosis; or such a modifier gene could have been lost or shifted by an abnormal crossing over. Another possibility could be a differential expression of the melanic gene caused by differences in the physiological (genome) enviroment on the two sides.

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NOTES ON CERTAIN LEPIDOPTERA OVIPOSITING ON PLANTS WHICH ARE TOXIC TO THEIR LARVÆ

by R. Straatman

It has been observed that females of certain species of butterflies occasionally lay eggs on plants, generally belonging to the same family as the natural hostplant, but on which the larvæ did not survive. Such behaviour was described by other authors (Dethier 1942, Edwards 1935, Remington 1952) and was recently mentioned of two Sumatran Papilionidæ (Straatman & Nieuwenhuis 1961). In Queensland, Australia it has been observed in the following four species.

1. *Troides priamus richmondius* Gray is locally common in South-eastern Queensland. In March 1960, at the promontory of Burleigh Heads, 60 miles south of Brisbane, where this species is very localised, several females were observed laying eggs on *Aristolochia elegans* Mast. This plant has been introduced from Brazil and is common in the area. A total of 70 eggs were collected from several of these plants and a similar number was left untouched. From the eggs, 61 larvæ hatched in the laboratory at Samford, 14 miles N. N. W. of Brisbane, and 40 of them were reared in the insectary on *A. elegans* growing in pots. Six larvæ died in the first instar, 22 in the second and the remainder in the third instar. The other 21 larvæ had been released on plants of *A. elegans* growing outside, along the creek. About a week after their release, the plants were inspected and a number of first instar larvæ found; later inspections, however, showed only few larvæ in the second instar and none were found beyond this instar. The leaves showed but little feeding damage. In the third week of April the plants from which the eggs were collected at Burleigh Heads, were inspected carefully, but apart from many eggshells suggesting a good hatch, not a single larva was found and the leaves showed only little damage caused by feeding. Freshly laid eggs, however, were again present. A few hundred yards from these plants, larvæ of *T. priamus* were found in all instars on *Aristolochia prævenosa* F. Muell., a native species and apparently their natural hostplant. Here it forms vines climbing into the forest canopy.

Another locality were *T. priamus* occurs, but where *A. elegans* appeared to be absent, is Tamborine Mountain (1800 ft., 22 miles N. W. of Burleigh Heads). Here, *A. prævenosa* is locally common in the rain-forest and numbers of eggs and larvæ of *T. priamus* were collected and transferred to Samford. The larvæ were released on *A. elegans* growing

in pots in the insectary. At first they refused to eat and were very restless, but after two days most specimens started an irregular feeding. However, most of these larvæ died in the second week of their transfer, while larger specimens survived for four weeks, growing smaller and weaker until they died. All the larvæ which had hatched from the eggs died in the first instar.

2. *Eurycus cressida cressida* Fabricius is a common species in the Brisbane area where its host is *Aristolochia pubera* R.BR. a small plant generally found in shady palces between rocks and weeds. At Samford, females of *E. cressida* were frequently observed laying eggs on *A. elegans*. Numerous eggs, which are bright orange and conspicuous, were collected and transferred to the insectary. The resulting larvæ were released on *A. elegans*, which they accepted more readily than did the larvæ of *T. priamus*, but no specimens survived beyond the third instar.

3. *Papilio demoleus sthenelus* MacLeay is the only papilionid which occurs in the dry inland areas of Australia, where EDWARDS (1948, 1955) recorded *Psoralea* (Leguminosæ) as its natural hostplant. In some years migratory flights reach the coastal areas, and in Southeastern Queensland *P. demoleus* is found every year, although sometimes locally and in small numbers. In March 1960 eggs and larvæ were found on a young *Citrus* plant near Samford and transferred to the laboratory. The larvæ continued to feed normally on leaves from the same plant until they reached the last instar. From then on they sat motionless for days, refusing to feed, and finally died. The larvæ which hatched from the eggs showed a similar behaviour and died in the last instar. When inspecting the citrus plants growing in the immediate vicinity of the tree from which the specimens had been collected, a small number of fourth instar larvæ of *P. demoleus* were found but left undisturbed. Frequent inspections showed that these larvæ also died in their final instar.

In the first week of April, numerous *P. demoleus* butterflies were seen at Samford, flying in and around a swampy paddock, which was overgrown with tall grasses and weeds. Female butterflies were seen ovipositing on a small weed, identified as *Psoralea tenax* (Leguminosæ). A search resulted in 25 eggs and 20 larvæ in various instars which were transferred to the insectary. Ten larvæ which were reared on *Psoralea,* grew rapidly and pupated. The other ten larvæ were reared on *Citrus,* accepted after a day of restlessness, but all died before pupation.

From the eggs, 24 larvæ hatched, which were divided into two feeding groups; 12 were given *Citrus* and 12 *Psoralea tenax*. The *Citrus* feeders were slow growers; while these were still in the first instar, the control specimens on *Psoralea* had reached the third instar. No *Citrus* feeders lived beyond the second instar, by which time some *Psoralea* feeders

started to pupate. Neither eggs nor larvæ of *P. demoleus* were found on *Citrus* plants growing in the immediate vicinity of the paddock. The specimens collected on *Citrus* as described were found in a much drier and hilly area where it is unlikely that *Psoralea* occurred. It was noticed that larvæ which lived on *Citrus* had a bright orange groundcolour in the fourth and fifth instars with distinct black markings, while most *Psoralea* feeders showed a green to pale yellow groundcolour with reduced black markings.

4. *Euplœa eichhorni* Staudinger is common in Northeastern Queensland and it is supposed that its hostplants belong to the Apocynaceæ or the Moraceæ. On several occasions, females were observed in the garden around the laboratory at Ingham while laying eggs on Frangipani (*Plumeria acutifolia,* Apocynaceæ). When damaged, this plant produces a milky sap and in this respect resembles the plants which would be the normal hostplants. Numerous eggs were seen but no larvæ found, while no plants showed any damage caused by feeding. When again, a female was observed ovipositing on Frangipani, 12 eggs were collected and transferred to a petri-dish. The larvæ hatched after five days and were given young leaves of the same plant from which they were collected. However, after nibbling at the leaves they refused to feed and died during the second day after hatching.

Discussion

Observations such as described above suggest that ovipositing butterflies are not infrequently deceived by attractive stimuli from abnormal hosts, to such an extent that eggs may be laid on plants which are, in fact, toxic to the resulting larvæ. In the case of *Aristolochia* species, this is presumably due to the close relationship of the normal host to the toxic plant. It is significant that, in the cases described, the toxic species (*A. elegans*) is an introduced plant, and there has apparently been insufficient time as yet for the butterfly to become adapted, *i.e.,* either to develop the ability to feed on it, or to discriminate during oviposition. It is perhaps also significant, that in the case of *T. priamus richmondius,* larvæ, from the area where the introduced plant does not seem to occur, died in the first instar. Those from the area where both species of *Aristolochia* occurred, did survive until the third instar, suggesting that some degree of adaptation may be evolving.

In the case of *P. demoleus,* its reported hostplants in countries other than Australia are species of Rutaceæ. However, Edwards (1948 and 1956) reported that in the Mitchell area (more than 300 miles west of Brisbane), *P. demoleus sthenelus* feeds on *Psoralea patens* and *P.*

tenax and that he was not able to rear it on *Citrus*. HELY (1958), replying to EDWARDS's paper, than stated that in 1943 and 1950 he had found larvæ and pupæ of *P. demoleus* on young citrus plants in the nursery of the Gosford Experimental Station, Narara, N. S. W. and that he had succeeded in rearing these specimens on *Citrus*. He also reported that in 1953 MOSSE ROBINSON had observed a female of *P. demoleus* ovipositing on *Psoralea affinis* in a garden at Gosford and successfully reared specimens on that host plant; also that he had collected and successfully reared larvæ on *Citrus*. Previously, WATERHOUSE (1932) had written "during 1922 on the Richmond River it occurred in thousands; if a branch of an orange-tree was held up by the hand, the females would lay their eggs on it". He also mentioned *Salvia* as a foodplant, as did RAINBOW (1907), but gave no details.

A foodplant of *P. demoleus* in Ceylon and India, mentioned by MOORE (1880), SEITZ (1927) and WOODHOUSE (1950), is *Glycosmis pentaphylla*, a rutaceous weed which also occurs in Northern and Northeastern Australia, where however, as far as is known, larvæ of *P. demoleus sthenelus* have never been found on this host.

The evidence available suggests therefore that *P. demoleus* may have developed separate local strains that differ in their association with *Citrus*: in Queensland rarely laying on and unable to develop on *Citrus* plants; in N. S. W. evidently accepting *Citrus* with complete success. It should be noted that, as in the case of *Aristolochia elegans*, plants of the genus *Citrus* are not native to Australia and it is possible that in this country *P. demoleus* became adapted to native plants of the genus *Psoralea*. With the introduction of *Citrus* plants, which are the normal hosts in other countries, it may have become possible, either for local populations of *P. demoleus* to revert to the ancestral feeding habit, or to develop *Citrus* feeding strains from eventual immigrant butterflies. No explanation can be seen, however, for the original selection of the quite unrelated *Psoralea* as a hostplant, when native species of rutaceous plants are available. In fact, as far as is known, there are no other records of a leguminous plant as the normal host of a papilionid.

In Australia several *Euplœa* species have been reported from host-plants belonging to the Apocynaceæ and the Asclepiadaceæ; members of these families generally have a milky sap.

Frangipani (*Plumeria acutifolia*, Apocynaceæ) is an introduced plant and is common in parks and gardens. As far as is known, no damage caused by *Euplœa* larvæ has ever been recorded on this plant. The normal host of *E. eichhorni* has not been described but probably belongs to one of the two above families. Once again we find that the abnormal, toxic host is an introduced plant, related to what is probably the normal

host, and presumably resembling it in the stimuli which attract ovipositing females. In this case however, there is no evidence to suggest that any adaptation to this new host has yet occurred.

Summary

Females of four species of Australian Lepidoptera were observed ovipositing frequently on introduced plants on which the resulting larvæ were unable to survive because of toxic effects. These species were *Troides priamus richmondius, Eurycus cressida cressida, Papilio demoleus sthenelus,* and *Euplœa eichhorni.* In most cases the toxic host is closely related to the normal native host plant, except in the case of *P. demoleus sthenelus,* ovipositing on *Citrus,* its normal host in other countries.

Acknowledgments

The author expresses his sincere gratitude to Dr. D. H. Colless of the Division of Entomology, C. S. I. R. O., Canberra, for his advice and assistance in the preparation of this manuscript.

The writer is also grateful to Mr. M. Gray, of the Division of Plant Industry, C. S. I. R. O., for identifying specimens of the host plants.

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A RARE PAPER OF W. F. KIRBY

by Paddy B. McHenry

Through the effort of Mrs. Halmos, Librarian of the Allan Hancock Foundation at the University of Southern California, S. H. Scudder's copy of W. F. Kirby's rare little paper titled "*A List Of British Rhopalocera.*" has been located in the Foundation's library (*ex* Boston Society of Natural History library). The copy has been signed by Scudder on the title page with the date "May, 1872."

Hemming (1934, p.169) gave an account of what was known of the paper at that time.

The title page of the paper is as follows: "*A List/ Of/ British Rhopalocera./ Printed On One Side Only,/ For Labelling Cabinets./ Including Nearly All The Varieties And Doubtful Species./ By W. F. Kirby./ Price 3d./ Brighton:/ H. Hallis, Printer And Bookseller, 5, Bartholomews./ 1858.*"

The paper consists of the following: the title page with its reverse side and pages [1], [2] and [3] each with a blank reverse side; the reverse of the title page has a brief [preface] which is signed "W. F. K." and dated "Brighton, February 4th, 1858."

Kirby, in the paper, indicates original material with his initials W. F. K. He gives as original: Theclides on page [2]; Lycænides and Polyommatides on page [3]; *Pelion,* a new genus, on page [3]; *Colias hyale hyalis* on page [1]; *Eugonia* [*species?*] *urticææ* on page [2]; *Nomiades arion orion* on page [3]; *Lycæna hemichrysos, Lycæna candida* and *Lycæna tesselata,* new varieties of [*phlæas?*] on page [3]. Descriptions for the varieties are given in brief foot notes; there is no description for *urticææ* which makes it *Nomen nudum.* Kirby also gives his initials with the combination *Epinephile janira* Linn. on page [2].

The complete text for the genus *Pelion* consists of two lines of text as follows: "Pelion, *W. F. K.*" and "Linea, *Fabr.*"

If any name in this paper has not been used since this 1858 publication, its nomenclatorial status seems questionable.

As indicated above, no page in this paper is numbered. The purpose for which this paper was printed, as indicated in the full title, suggests the reason for its present rarity.

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THE GENETICS AND REPRODUCTIVE ISOLATING MECHANISMS OF THE *PIERIS NAPI - BRYONIÆ* GROUP (cont.)

by Z. Lorkovic

III. Genital Armature

One of the most important reasons why *bryoniæ* and *napi* have been considered to be conspecific is that no structural characters have ever been detected between the genitalia of the two forms in either sex. But this lack of differences need not be a decisive proof for their specific identity, since good species are known without any remarkable distinction in the genitalia. The structural identity of copulatory organs is also evident from the fact that the pairing between *bryoniæ* and *napi* takes place without mechanical hindrance. The other possible sexual isolating mechanisms will be discussed below.

IV. The Karyotype

The chromosome complexes of *napi* and *bryoniæ* are identical in haploid chromosome count in the spermatocytes, with $n = 25$. The chromosomes are too small to show qualitative differences if standard cytological methods are used. An indirect indication for the qualitative differences could be given by the disturbance in the chromosome pairing during meiosis of the hybrids. Unfortunately a lot of fixed hybrid testes were accidentally lost on the occasion of a laboratory remodeling, but new testis material is in preparation and will be reported later.

V. Physiological and Ecological Characters

It has been impossible to carry out genetical analyses of the physiological features of the two forms owing to technical difficulties in our laboratory some 13 years ago. But since these physiological traits are as significant for their ecological interrelations as for their distribution, the most obvious gross differences are listed in Table 5.

Among the characteristics listed in the table, the number of annual generations and very likely also temperature tolerance are heritable. Both traits are modifiable to a certain extent through environmental influences, and should therefore be looked into more thoroughly.

We do not know to what extent foodplant preferences are hereditary or due to microclimatically conditioned behavior of the insects. No

Table 5. The Physiological and Ecological Differences between *bryoniæ* and *napi.*

Feature	*bryoniæ*	*napi*
Activity dependence on laboratory temperature	Above 28°C; in sunshine the ♂♂ sit exhausted in the shade, in ♀♀ no or slight egg-laying.	Above 28°C ♂♂ and ♀♀ fly in sunshine without sign of fatigue, egg-laying good.
Copulation	At 23°C and when cloudy, copulation frequent (P = 0.857); in sunshine infrequent (P = 0.162) (Petersen 1954).	At 23°C and when cloudy, copulation P = 0.143; in sunshine P = 0.838 (Petersen 1954).
Egg-laying flight	In the lowland populations ♀♀ fly from the wood to the meadow when cloudy, but return immediately to the wood when sun appears (Petersen 1954).	No striking behavior. The ♀♀ will lay the eggs in the open, though mostly in thin wood or at the border of the wood.
Food plants	In all investigated biotopes *Biscutella lævigata* is either the only food plant of the single-brooded populations or the preferred food plant in addition to *Thlaspi* and *Arabis* in low regions (according to the writer's observations as well as to Kautz 1939 and Petersen 1954). Only on Monte Mottarone near Lago Maggiore *Arabis halleri* is the exclusive food plant, since *Biscutella* is absent there (Petersen 1954).	No particular preference for a certain food plant, Foods are as follows: *Brassica, Rapa, Erysimum officinale, Raphanus raphanistrum, Cardamine amara* and *pratensis, Diplotaxis tenuifolia* and *Reseda* (Verity 1944); *Armoracia, Barbarea, Sinapis, Sisymbrium, Alliaria* (Kautz 1939); *Roripa silvestris* near Zagreb, *Cardamine trifolia* in the Julian Alps, *Biscutella lævigata* in the Julian Alps and in Montenegro.
Habitat preference	In the Alps between 1000-2200 m. only one generation. In the southern valleys down to 200 m. completely or partially 2-3-brooded. The single-brood of the highland populations modifiable through high temperature in which a certain percentage of pupæ develop without hibernation (diapause).	Everywhere 2-4 brooded. Where the single-brooded *bryoniæ* population borders with the two-brooded *napi* the flying time of the *bryoniæ* falls between the two generations of *napi.* Where multiple-brooded populations of both forms occur together, *napi* imagos seem to appear prior to *bryoniæ* (Kautz 1939).
Number of generations and pupal diapause	Mainly regions of *Pinus mughus* between 1100-2200 m. altitude. Below 1000 m. altitude, localities with *P. mughus* removed to the valley by torrents, if lower down localities with Black-pines (*Pinus silvestris*).	In the plain as well as in the mountains up to 1500 m. altitude, thin woods and borders of woods, less frequently open meadows, since the egg-laying occurs mostly in shady spots.

preference of *bryoniæ* for *Biscutella* over other Cruciferæ (as claimed by PETERSEN for his samples) was noted in captive populations by various breeders or by me. This applies not only to *bryoniæ*, but in general more or less for other closely related pierid species that I have investigated in laboratory tests (*P. rapæ, manni, Anthocharis cardamines, belia, Pontia daplidice, Synchloë protodice,* etc.). Notwithstanding, it is significant that *Biscutella* was found as the food plant of lowland *bryoniæ* too, for example in Posavje near Ljubljana at the eastern part of the Karavanke Alps (Petersen 1954). However, near Hrastnik on the extreme limit of *bryoniæ* range in Posavje, I found a small *Arabis* sp. on which a white *bryoniæ* female laid eggs. *Vice versa* I have also seen *napi* females laying on *Biscutella* in the Julian Alps as well as at Durmitor in Montenegro at 1400 m. altitude. Slight differences of behavior toward foodplant species are difficult or impossible to detect in laboratory tests, and various cruciferous species known to be foodplants for *bryoniæ* and *napi* should be transplanted to the natural biotopes of the two butterflies in order to test subtle differences in the strength of attraction of different plants to egg-laying females. Unfortunately, in this Atomic Age, funds are not available for such a harmless project.

In short, in the ecology of the two forms, especially in their physiological ecology, much remains to be resolved.

RELATIONS BETWEEN MORPHOLOGICAL VERSUS COLOR CHARACTERS AND PHYSIOLOGICAL-ECOLOGICAL ONES. We have not been able to discover whether and how far a relationship may exist between any morphological features and any physiological (*i. e.*, ecological) ones; that is, we can say very little about possible pleiotropy of the color genes for which the Mendelian behavior is known.

We have obtained some results for the allele pair *B, b*. Through ten generations, in which *bryoniæ* × *napi* hybrids have been either crossed to each other or back-crossed with *napi*, the phenotypic manifestation of *B* has been maintained, but no remarkable differences in behavior, vitality or number of generations between *Bb* and *bb* individuals have been observed. After these many crossings, the allele *Y*, which controls the brownish yellow color, was completely lost, since the presence of this highly sex-controlled gene was not manifested in the males, so that one could never know what a male carried. Thus, no one of the physiological traits considered seems to be related to the gene *B*. Such characters, however, could be perhaps related to *Y*, since yellow strains will not hold out for more than a few generations.

Great difficulty attended the attempts to maintain the *W* factor, which was never obtained in the homozygous condition. More detailed experi-

ments should of course be carried out, but it is evident that the typical physiological characters of *bryoniæ* cannot be related to the *W* gene simply because there is only such a slight concentration of this gene in certain typical *bryoniæ* populations.

If the three allele pairs of *bryoniæ* and *napi* have no correlation with the physiological and ecological characteristics of these two forms, then these genes are bound to have a direct selective advantage. It may be that the dark and yellow-brown pigments act to capture radiant heat, which would be an advantage for animals of colder areas and would explain the distribution of the two forms in relation to climate. The adaptive correlation of *W* is unknown, but it could conceivably be investigated by comparing habitats of the populations with various concentrations of this allele.

VI. Recombination in Nature

We come now to our main subject: to what extent may the amount of gene flow or, in other words, the frequency of crosses between *bryoniæ* and *napi* in nature be deduced from the frequency of recombination in nature? In standard taxonomic practice, the amount of recombination is usually judged by the presence and proportions of intergrading morphological types found where two populations are in geographical contact. If intergrades are absent or very rare, the two populations are judged as species; if intergrades are common, judgement is usually for subspecific status of the populations.

Curiously enough the recombination situation in the *napi* - *bryoniæ* complex differs strikingly on the northern and southern sides of the Alps. Though both forms occur on both sides of the Alps, their recombinations are very rare on the northern side, while at the southern approaches there exist all the recombinations described above.

Tables 6A to 6C and Figures 4 and 5 (from Petersen 1954) show variation classes of two characters, the dark markings and ground color. In these tables, *napi* is represented by the horizontal classes 1-3 and vertical 1 - 2, *bryoniæ* by horizontal classes 5 - 9 and vertical 2 - 6. Table 6A illustrates clearly how in the Allgäuer (northern) Alps, *napi* and *bryoniæ* are sharply distinct from each other, the intermediates numbering only one out of 174 samples. But in the south, for instance in Carinthia, as shown in Table 6B, there is no distinctly concordant gap between the variations of the two forms. Class 4 (horizontal), contrary to its rarity in the northern Alps, is in Carinthia even more common than the typical *napi* class 2 (horizontal). The most frequent combinations (bold face

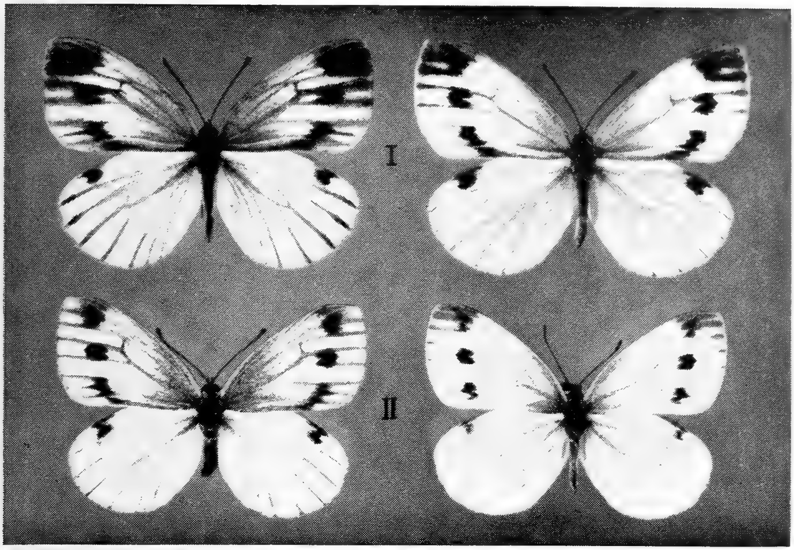

Fig. 3. Segregation in *bryoniæ* and *napi* females in two backcrosses resulting from the mating of two similar heterozygous *bryoniæ* sisters and two differently marked *napi* fathers: The father of brood I (upper level) had the melanic pattern very extended and dark, whereas the father of brood II (bottom) had the pattern very reduced and pale. At left are heterozygous *bryoniæ* ♀♀, *Bb*, at right *napi* ♀♀ homozygous for *bb*.

numbers in the tables) are much closer together in Table 6B than they are in Table 6A. The discontinuity in the Vienna area (Mödling) appears to be nearly or quite completely lost (Table 6C). Since Tables 6B and 6C are based on museum specimens, *napi* may be under-represented, as PETERSEN has rightly pointed out. This suspicion was confirmed by his investigations near Mödling, through which he learned that *napi* is really more frequently present than as noted in Table 6C. My investigations in the Yugoslavian section of the southeastern Alps (Karawanke and Steiner Alps) are in substantial agreement with those of PETERSEN, but from here we also have breeding and crossing studies.

So at Fala in the Drava valley (about 300 m. altitude) near Maribor (Marburg) a mixed *bryoniæ* (*flavescens*) and *napi* population occurs (Table 6D). Both forms are double or even triple brooded. In the offspring of one of two wild yellow *bryoniæ* females captured between 7 and 9 July 1931 (brood "Fala 1") were one *bryoniæ* male and one *napi* female. (At that time my rearing methods were still very imperfect, and a great number of caterpillars died of diseases. Later on, this obstacle was entirely removed.) They paired and yielded four imagos: 1 white

Table 6. Frequency of variation classes of dark markings and yellow color in five localities (see text).

Dark markings

Yellow color	1	2	3	4	5	6	7	8	9	
1	4	12	8	-	-	-	-	-	-	24
2	-	3	1	-	-	-	-	-	-	5
3	-	-	-	1	-	1	3	12	1	54
4	-	-	-	-	1	3	16	28	6	18
5	-	-	-	-	-	5	21	42	5	73
6	-	-	-	-	-	1	2	2	-	5
	4	15	9	1	1	10	42	85	12	179

A. Allgäuer Alps (northern Alps).

	1	2	3	4	5	6	7	8	9	
1	1	2	3	1	-	-	-	-	-	7
2	-	3	6	2	2	3	4	2	1	23
3	-	-	2	2	2	2	3	1	1	13
4	-	-	-	1	4	6	2	2	2	17
5	-	-	-	-	2	-	2	1	-	5
6	-	-	-	-	-	-	-	2	-	2
	1	5	11	6	10	11	11	8	4	67

B. Carinthia (southern Alps).

	1	2	3	4	5	6	7	8	9	
1	1	2	-	-	-	-	-	-	-	3
2	1	1	1	6	3	2	-	-	-	14
3	-	3	3	3	3	1	-	-	-	13
4	-	1	1	1	4	-	-	-	-	7
5	-	1	2	1	2	1	-	1	-	8
6	-	-	-	-	-	-	-	-	-	0
	2	8	7	11	12	4	0	1	0	45

C. Mödling and the environs of Vienna.

	1	2	3	4	5	6	7	8	9	
1	1	1	-	-	-	-	-	-	-	2
2	-	1	-	1	1	-	-	-	-	3
3	-	-	1	1	1	-	-	-	-	3
4	-	-	-	-	1	2	-	-	-	3
5	-	-	1	-	-	-	1	-	-	2
6	-	-	-	-	-	-	-	-	-	0
	1	2	2	2	3	2	1	0	0	13

D. Fala (Drava Valley).

	1	2	3	4	5	6	7	8	9	
1	-	1	-	-	1	-	-	-	-	2
2	-	-	-	-	-	1	-	-	-	1
3	-	-	1	1	1	1	1	-	-	5
4	-	-	-	-	2	-	-	-	-	2
5	-	-	-	-	-	1	-	-	-	1
6	-	-	-	-	-	-	-	-	-	0
	-	1	1	1	4	3	1	0	0	11

E. Rogovilec (Savinja Valley).

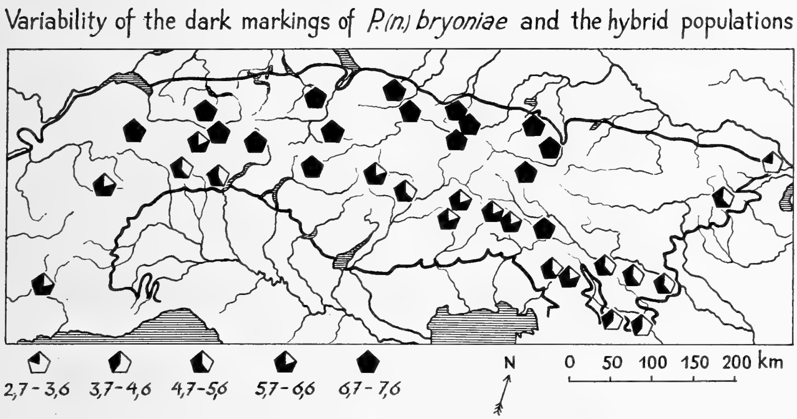

Fig. 4. Variability of the dark markings in the Alps (modified from Petersen, 1955).

bryoniæ female, 1 white *bryoniæ* mosaic intersex, 1 *napi* male, and 1 *napi* female, a back-cross ratio as would be expected. From the other female ("Fala 2") three generations were obtained and from two sib matings reared together, 44 *bryoniæ* and 3 *napi* females emerged, one of the latter having been yellowish. One of these two matings was probably *BB* × *Bb*, the other *Bb* × *Bb*. Thus it has been proved that among the offspring of *bryoniæ* females from this locality specimens with *napi* traits segregate which cannot be distinguished by their phenotype from pure lowland *napi*. Thus it seems likely that the population of Fala has some similarity to that of Mödling.

Another *bryoniæ* population from which some broods were also reared has been found in the upper Savinja valley on the eastern end of the

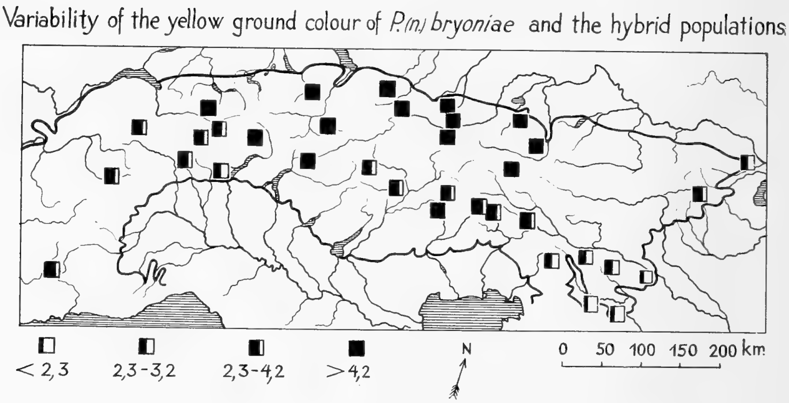

Fig. 5. Variability of yellow ground color in the Alps (modified from Petersen, 1955).

Karawanken Alps (Table 6E). Here all three pairs of *bryoniæ* alleles are still present, since among five males one "rubtalba" *napi* was found. Among 11 females taken here at Rogovilec (about 650 m. altitude) during 10 to 17 August 1931, 2 show *napi* pattern on the yellowish versus white ground color. From the eggs of one female 3 imagos were reared the next spring. One of these, a deep yellow "radiata" female, already mentioned (brood "R × P - 1932"), mated with a *napi* male from Podsused near Zagreb, where no other than homozygous *napi* occur. The 58 female descendants segregated in a dihybrid back-cross ratio, *i.e.* 14 yellow "radiata", 14 white or whitish "radiata", 16 yellow or yellowish *napi*, and 15 white *napi*. Accordingly, the "radiata" mother of this brood had been heterozygous for both the *Bb* and *Yy* alleles. It has also to be noted that a cross between one male of the three specimens reared from Rogovilec and a *bryoniæ* female reared from Fala gave 11 *bryoniæ* and 12 *napi*, both more or less yellowish, but among them were also three white *napi* which did not differ from any pure *napi*.

Properly speaking, not one of about ten *bryoniæ* broods from these two localities was true-breeding. If we add that the most characteristic wild *bryoniæ* females were selected for the breeding experiments, one can easy imagine how highly mixed must be the genetic constitution of both the Fala and Savinja populations.

On the strength of these breeding results, supported by PETERSEN'S analysis of the colonies at Mödling and Carinthia, the conclusion must follow that the *bryoniæ* populations of the south-eastern Alps cannot

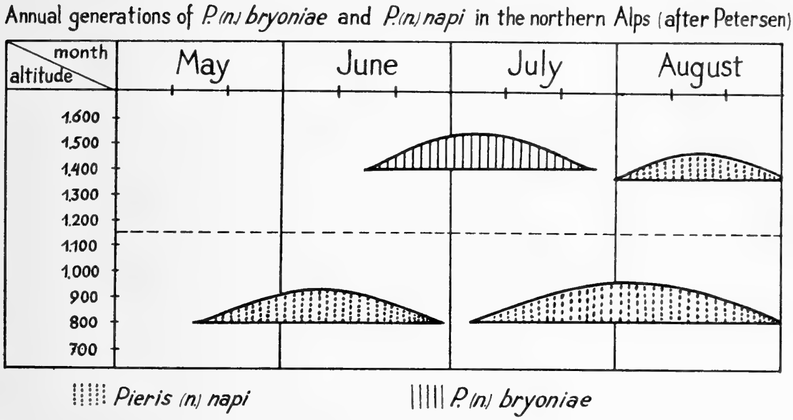

Fig. 6. Seasonal and altitudinal distribution of *Pieris bryoniæ* (univoltine) and *napi* (uni- or bi-voltine) in the northern Alps.

be considered as a closed genetic entity reproductively separated from *P. napi,* because all these populations carry a more or less large amount of *napi* genes. The excellent Table 8 in the Müller-Kautz work shows at a glance that what is true for the Falla and the Savinja valley is not less applicable to the more western parts of the Karawanken slopes, especially for the Singerberg district southward of Klagenfurt. This table likewise represents a clear dihybrid segregation, and if the undersides of the hindwings had been visible too, a tri-hybrid segregation would appear.

But once we have established the great difference in recombination frequency between the northern and southern Alps, how do we explain this unexpected situation? Part of the answer lies in a comparison of the ecological and temporal isolation between the two forms in the two regions. In the northern Alps, *bryoniæ* and *napi* are sharply spatially and temporally isolated. There, *bryoniæ* is almost exclusively single-brooded, and lives between 1350 and 1750 m. altitude. Its flight period lasts from mid-June until the end of July, with the greatest activity from the end of June to mid-July (Fig.6). *P. napi,* on the other hand, does not occur above 1150 during its first generation, and here flies from mid-May to mid-July, although at the end of the flight period, in mid-July, it does in rare cases fly up nearly to 1700 m. The second brood of *napi* flies after mid-July, but mainly in August, at a time when *bryoniæ* ♂♂ are finished and all of the *bryoniæ* ♀♀ have already been fertilized. There is only a slight chance of the two forms meeting during their

mating periods. The exceptions are so infrequent as to be insignificant, but we shall mention them again later.

On the southern side of the Alps, *bryoniæ* lives at altitudes above 1100 m. and there has only one generation, as in the northern Alps. But it also occurs at lower elevations. On the slopes of the Karawanke Alps its range extends in the Sava Valley down to 200 m. Below 1100 m. *bryoniæ* is two-brooded, and in the lowlands partially even three-brooded. It therefore overlaps *napi* spatially and temporally in adult breeding condition, so that one would expect to find all Mendelian combinations possible between the two forms. Indeed, this is just what was found, and summarized in Tables 6B-6E.

Despite the fact that conditions are favorable for a mixture of the two forms, their blending is still not total. PETERSEN (1954) argued as highly probable that in the populations from Mödling and Posavje (Save Valley) the hybrid populations would be slightly less well represented than either "pure" form ($\chi^2 = 11.80$, $P<0.001$). Hybrids do appear to be much rarer at higher elevations in the southern alpine valleys than they are in the lowlands. In Krnica Valley at the base of Prisojnik Peak in the Julian Alps, there lives at 1100 m. in a thin, low beech wood a pure *napi* population, while outside this wood in the vicinity of the torrents, where *Pinus mughus* forms the main cover, *bryoniæ* (partially two-brooded) are seen flying. The caterpillars of *napi* live in the beech forest on *Cardamine trifolia,* while those of *bryoniæ* feed on the plants of *Biscutella lævigata* that fringe the low pine cover, Both butterflies remain faithful to their habitat and food-plant preferences. In conditions of frequent hybridization, these physiological characters should be expected to form recombinations with the morphological ones. Proof that crossing is probably rather limited in Krnica Valley is the lack of the W gene in the *napi* individuals, while in *bryoniæ* this gene is present in almost half of the individuals. Furthermore, yellow *napi* ♀♀ (*Yy bb*), which segregate only in the F_2 and the back-crosses, are here much rarer than in the Sava Valley or at Mödling. Thus we see that in the higher parts of the southern Alps circumstances are much as in the northern Alps; that is, crossing appears to be considerably less frequent than in the lowlands. In the vicinity of the Vršič pass between 1400 and 1700 m., almost fresh *bryoniæ* of the first brood were found late in June and only one old *napi* female at 1400 m. More fresh *napi* females were found here in the first half of August when only the last few worn *bryoniæ* were on the wing. This fact corresponds well with the lack of phenotypically detectable recombinations which carry the recessive allele *b,* since the recombination yellow *napi* females (*Yy bb*) were not yet

observed at these elevations in the Julian Alps. Thus one might get the impression that *bryoniæ* and *napi* of the Julian Alps are as strictly reproductively isolated as they are in the northern Alps. This conclusion revealed itself as incorrect after some breeding and crossing experiments that led to a quite unexpected result.

In the biotope of the "pure" *bryoniæ* just mentioned, caterpillars of *bryoniæ* were collected on *Biscutella* late in July 1947, and these were bred through to butterflies. These adults were partly paired among each other and partly with *napi*. Of seven such butterflies that paired and produced progeny, at least three (2 ♂♂, 1 ♀) were heterozygous for the *B* gene (broods 2 b, 4 b, 5_2). Two matings with *napi* yielded half *bryoniæ* and half *napi*, while pairing with *bryoniæ* yielded partly heterozygous animals, a fact manifesting itself only in their progeny, since in none of these four insects was it recognizable that they were of mixed type.

It follows from this that the apparently pure highland single-brooded *bryoniæ* population of the Julian Alps is far more heterozygous, *i.e.* mixed with *napi*, than could be expected from its morphological features. This "unexpectedness", however, surprises only those who claim *bryoniæ* to be a separate species, whereas in the view of the others the remarkable percentage of white *bryoniæ* females in this district points to a considerable flow of *napi* genes into this *bryoniæ* population. With such a situation in highland populations, how large must be the inflow of *napi* genes in lowland *bryoniæ* populations like those from Mödling near Vienna, where the appearance of obvious hybrids nobody can deny. The circumstances remain as yet somewhat obscure only in the many *bryoniæ* "races" from lowland districts of the Carpathian Mountains in Czecho-slovakia, as described by Moucha (1956, 1957, 1959).

It does seem that the relatively large number of heterozygous insects captured in the larval stage in the higher elevations of the Julian Alps is fortuitously somewhat exaggerated, since the offspring of the *bryoniæ* females captured as imagos in the same region and already fecundated there consisted of *bryoniæ* as a rule. This may be explained by the fact that on the biotope of *bryoniæ*, heterozygous insects pair predominantly with homozygous ones where the latter are in the majority, or perhaps the inbreeding F_1 hybrids show a decreased fertility that would put a strict limit to recombinations. Regardless of the explanation, this situation demonstrates with force how easily we may be mistaken about the genetic constitution of a population if it be considered only from the morphological point of view.

Crossing between *bryoniæ* and *napi* is not restricted to the southern Alps, since hybrids have occasionally been found in the northern Alps. PETERSEN (1954b) discovered a *bryoniæ* ♂ × *napi* ♀ copulation in the Allgäuer Alps, and there is a similar report by another writer. If we consider the fact that copulation in butterflies is rarely seen, even under the best conditions, then these two observations signify a relatively frequent occurrence of cross-pairing, conforming to the discovery of heterozygous *bryoniæ*. Though we have established that the single-brooded high-altitude *bryoniæ* populations are genetically not so pure as has been supposed, it is nevertheless evident that the crossing of two forms is not unlimited. Two factors seem worth further consideration: (1) sexual isolation and (2) the biotope preference.

VII. SEXUAL ISOLATION

In the discussion of the physiological traits of our two forms, the question of sexual isolation has purposely been set to one side, so as to allow unbiased evaluation of the degree of reproductive isolation from data on recombination. In captivity, crosses between *bryoniæ* and *napi* are rather readily carried out although not always, a result quite at variance with the usual difficulty in crossing fully distinct species of pierid butterflies (Lorković 1928, 1957). But it has been noticed in the crossing tests that mating between *bryoniæ* and *napi* is not absolutely free, either. PETERSEN (1952) and I have discovered independently that *napi* males are only slightly or not at all attracted by the yellow females. PETERSEN made experiments with dummies, in which he was able to demonstrate that yellow dummies only rarely attracted *napi* males. But the dark melanic *bryoniæ* coloration has no influence on the attraction of *napi* ♂♂; dark ♀♀ with a white ground color have the same attractive effect as the pure ones. In my experiments, the white or whitish homozygous *bryoniæ* females, however dark they may be, are immediately pursued by *napi* males as soon as noticed, and in a few seconds pairing occurs.

An unexpected result of PETERSEN's experiments showed that *bryoniæ* males also were much less attracted by the yellow *bryoniæ* females than by the white *napi* females. This certainly complicates the matter, since it would seem to speak in favor of hybridization in at least one direction. This finding also agrees with PETERSEN's observation of a *bryoniæ* ♂ × *napi* ♀ pairing in the northern Alps, as well as with the fact that he also obtained *bryoniæ* offspring from one *napi* ♀ from Mödling. Conversely, two *napi* ♀♀ captured in Krnica Valley yielded only *napi*

offspring (*bb*), and several caterpillars collected on *Cardamine trifolia* yielded only *napi* progeny. The attraction of *bryoniæ* males by yellow *bryoniæ* females must be largely a matter of the flight activity of the females. I have succeeded also in gaining attractiveness of the yellow females for *napi* males when the wings of the resting female were fastened in a folded position in such a way that the greenish-yellow *underside* of the hindwings (it should be not confused with the brownish-yellow color of the upperside) and the whitish underside of the forewings became visible.

Since even the *bryoniæ* males are not as strongly attracted by their own yellow females as by the white, the negative attitude of *napi* males in relation to the yellow females cannot furnish compelling evidence of strong sexual isolation between *napi* and *bryoniæ*. Sexual isolation by visual sense between the two forms is only a half-effective one, since in one direction (*napi* ♂ × *bryoniæ* ♀) hybridization is prevented, but not the reciprocal direction. Accordingly, the index of sexual isolation (ISI) calculated by the simplest way (*i.e.* the number of intraspecific minus the number of inter-specific matings divided by the total number observed [Smith, 1953]) would be + 0.33, a rather low value; the index of complete isolation being 1.0, and that of no isolation zero.

However, the visual attraction by color is not by itself decisive in promoting or preventing hybridization, since it represents an orientation factor for males at distance, as is evident from the well known fact that the males frequently approach other males as well as other white or whitish butterfly species. It is obvious that this distance-orientation behavior would sometimes lead to pairing errors if other isolating mechanisms did not act preventively. Among such more effective isolating factors the specific odoriferous substances come especially into play by stimulating particularly the females to render the copulation possible. In pierid butterflies such readiness for mating may be recognized by a special behavior: a flying female, when approached by the male, alights and puts her wings upward (as in the resting position), which enables the male to land by the female, and copulation can take place. A non-stimulated female spreads the wings down, while its abdomen protrudes upwards, a position which makes copulation impossible. The same behavior follows after mating. There seems to be little or even no difference between the sexual odors of *bryoniæ* and *napi*, since such a defensive posture of females against males of the other form was only exceptionally observed. However, a striking resistance of captive females to both the males, *bryoniæ* and *napi*, is not rare, but it seems to have nothing to do with sexual differences between the species.

VIII. Hybrid Viability

Reared F_1 hybrids develop well and show normal vigor. However, this applies perhaps only to the summer brood with the subitan development, since PETERSEN and TENOW (1952, 1954) found a rather great degree of mortality of the hibernating pupæ, especially in females. PETERSEN considers this female mortality as the most important isolating factor. In my crossings I had not the occasion to confirm this finding because in our broods the hybrids always developed as the summer brood in the same season without diapause. BOWDEN (1953) and BOWDEN and EASTON (1955) in their breeding in England obtained no significant mortality of F_1 hybrids, but stated that in certain broods, particularly when *bryoniæ* was the mother, "many females seem to complete their diapause abnormally early, even before the winter, and in consequence emerge before the usual time". As the males of butterflies under normal conditions emerge always a week or so before the females, BOWDEN held that just this "separation in time of emergences of the sexes provided an interspecific barrier of importance". If this separation applies for the hybrids in nature, I do not see why this early emergence of females would be a reproductive barrier, since *bryoniæ* emerge somewhat later than *napi* and so the backcrosses with *napi* males would be preferred, decreasing by this way the important infertility of the F_1 hybrids. The latter will be discussed in the following section.

IX. Hybrid Sterility or Infertility

The most obscure point in these investigations has been the question of the degree of hybrid sterility or infertility, although this is one of the two most important aspects of the relationship between the two forms. Unfortunately, the climate of Zagreb is badly suited during summer for the rearing of alpine butterflies, and the fertility of the animals in the laboratory is affected adversely by the heat (Table 7, Broods 2b and 4b). The results obtained will all therefore bear checking under more natural conditions.

In spite of the normal vigor of the F_1 hybrids as well as their apparantly normal gonads and germ cells, the fertility of the hybrids is obviously decreased but in a variable extent. In Table 7 is indicated the total of the offspring of the individual broods in the F_1 pairings, also of backcrosses and of pure *bryoniæ* pairings for different strains. Brood 1 b n represents 11 inbred pairings of F_1 hybrids of one single *napi* × *bryoniæ* cross which had produced 59 sound, vigorous hybrids. Series III shows 14 F_1 inbred pairings and 7 F_1 pairings among the progeny of various

Table 7. Fecundity of *napi* × *bryoniæ* hybrids, backcrosses and pure *bryoniæ* in laboratory breeding.

	Brood	Number of broods	Frequency of broods with respect to the number of offsprings							Total number of off-springs	Average number of offsprings per brood	χ^2
			0	1-9	10-19	20-29	30-39	40-49	60-69			
1 bn	F_1-inbred	10	5	4	1					16	1.60	
III	F_1-inbred	14	7	5	2					62	3.75	3.76⎱ $\chi^2=4.9583$
III	F_1-crossbred	7	1	4		1	1			76	10.86	10.86⎰ $0.02<P>0.05$
	Total	31	13	13	3	1	1	0	0	144	4.65	
III	R-inbred	5	1	2	1			1		66	13.20	
III	R-crossbred	5		2	2		1			81	16.20	4.65⎱ $\chi^2=7.8719$
III	R-wild	10	2	4	1	2			1	154	14.40	15.05⎰ $P<0.01$
	Total	20	3	8	4	2	1	1	1	301	15.05	
2 b	P-bryoniæ May, June	4		2	2	1				63	15.70	
4 b	P-bryoniæ July, August	5	2	1	1					18	3.60	
	Total	9	2	3	3	1	0	0	0	81	9.0	

parents, as well as 20 back-crosses (R) from 7 broods in which the F_1 hybrids were crossed either with wild *napi* or with *napi* from the F_2 generation. In the last case we are concerned with not entirely true back-crosses, since the *Bb* heterozygotes mate with the *bb* homozygotes of the same brood. As to the controllable *Bb* pair of alleles, this is of no importance, but for the other invisible characters, it is.

If we compare the mean values of the total offspring of all $F_1 \times F_1$ matings (144) with the total of the progeny of the back-crosses (301), the difference is striking ($x^2 = 7.8719$, $P < 0.01$), with the offspring of the $F_1 \times F_1$ pairings being almost three times less than in the back-crosses. But a more detailed comparison has revealed that the fertility of the F_1 broods varies considerably according to whether we are concerned with 1) inbred pairings from one single pair of parents, 2) inbred pairings in various F_1 strains, or 3) pairings among F_1 individuals of several different strains. The difference between the last and the back-crosses is less than that between the inbred and non-inbred F_1 matings. We may conclude that the decreased fertility of our F_1 hybrids is only partially due to the known reduction in fertility of inbred broods in general, since the inbred back-crosses show a fertility only slightly lower (13.20) than that of the non-inbred back-crosses (16.20 and 14.40).

Pure *napi* can be bred through three of four generations without an important decrease in fertility. This applies also to other species of Pieridæ: *P. rapæ, P. manni, P. ergane, P. daplidice.*

We have therefore to assume that the F_1 hybrids of *bryoniæ* and *napi* in the inbred matings have considerably decreased fertility, since a very small number of eggs is laid, and of these up to 90%, or even 100% remain either unfertilized or undeveloped. On the other hand, the matings of F_1 individuals from different strains are noticeably more fertile, and the back-crosses show a nearly normal fertility. It is to be recalled that some larvæ of *bryoniæ* were captured as natural heterozygotes; these have turned out to be normally fertile as reared adults. One of these *bryoniæ* ♀♀ yielded abundant offspring, even when crossed with a (*napi* × *bryoniæ*) ♂, indicating that neither the wild ♀ nor the F_1 of the laboratory brood would be very highly sterile. Two other wild heterozygous *bryoniæ* ♂♂, paired with two homozygous *bryoniæ* ♀♀ and one *napi* ♀, have also been established as normally fertile.

Our results, indicating a greatly decreased fertility of the F_1 hybrids, are in rather astonishing contrast to the facility with which BOWDEN obtained the F_2 generation by pairing F_1 individuals. On the contrary, in his crossings the difficulties arose with the third generation, which could not be obtained when F_2 individuals were mated *inter se,* so that

only the back-crosses were successful. The cause for this unexpected difference remains still obscure. BOWDEN inclines to the explanation that the difference between English subspecies of *napi* and the Continental one could be responsible for this hybridization difference in the sense "that the reproductive barrier between *bryoniæ* and the adjacent subspecies of *napi* would be rather greater than that separating the more distant British subspecies" which is in no contact with *bryoniæ*, an opinion expressed in a general sense by HUXLEY (1942). However, STEBBINS (1958: p.195) emphasized that "the available data do not indicate that those strains of the two species which occur sympatrically are more likely to form inviable or sterile hybrids than strains of the same two species which occur in different regions". In fact, it would be just as reasonable to suppose the English climate more suitable than that of southeastern Europe for the breeding of such alpine butterflies as *bryoniæ* and their hybrids. The breakdown with the F_3 generation could be accounted for as an effect of laboratory or breeding infertility.

In any case, the considerable degree of decreased fertility of F_1 and/or F_2 *bryoniæ* × *napi* hybrids remains somewhat puzzling.

X. ON THE DEGREE OF REPRODUCTIVE ISOLATION AND THE TAXONOMIC STATUS OF *Pieris napi* AND *bryoniæ*

Having established the genetical and reproductive relation between *bryoniæ* and *napi* we can try to relate the degree of reproductive isolation between them to the various stages in the process of speciation, *i.e.* are they subspecies or full species. Such an attempt turns out to be by no means so easy to perform as one could imagine. In spite of the well defined species concept of to-day, established by the comprehensive works of RENSCH (1929), DOBZHANSKY (1935, 1951), HUXLEY (1942), and MAYR (1942) as well as some other authors, it is clear only for sympatric populations; only in such cases may the existence of reproductive isolation be deduced without experimenting. In allopatric populations (forms, races, species, borderline cases), however, such a consideration of the degree of reproductive isolation is imposible; it always remains more or less subjective or arbitrary. Therefore, in this field of taxonomy great unconformity or even disagreement prevails. Especially difficult and apparently without any final criteria remains the designation for intermediate stages between geographic races and species, which is left to one's own judgment. MAYR (1931) attempted to alleviate the difficult situation by introducing the new category "superspecies", but in fact the subjectivity was not removed, since the superspecies is com-

posed mainly of allopatric "species" whose real isolation status remained uncertain. This began to be more and more important owing to the increasing experimental research on the innate reproductive isolating mechanisms in both animals and plants, often revealing incomplete stages of speciation. The lack of an appropriate taxonomic name or category for such an intermediary stage leads mostly the taxonomically uninterested workers to assign the uncertain cases either to subspecies or to species. Taxonomists, however, tend to promote such borderline cases to the species level, because of their unconscious desire to increase the actual number of species of the group they are dealing with. Clearly, such a situation cannot lead to a satisfactory knowledge of the actual occurrence of the borderline cases in nature, apparently highly underestimated so far. Moreover, an important difficulty for the establishment of objective limits between the subspecies and the species are the differences in the number and degree of isolating mechanisms between species in different groups, of both animals and plants (Stebbins 1958).

If we also add that the subspecies concept itself is seriously attacked or even denied (Wilson & Brown 1953, Gillham 1956, Burt 1954), it is clear that taxonomy at the infraspecific level is not in a satisfactory state.

In regard to these considerations we are now going to compare the relation between *napi* and *bryoniæ* with the circumstances in related pierid species known from my interspecific crosses carried out many years ago, although only a very limited part of this research has been published as yet (Lorković 1928, 1953, 1957). Of course, we shall try to account also for the generally accepted line in this matter and, finally, to formulate the characteristics of the intermediary stages between subspecies and the true species.

1) The first comparison which must be made concerns the morphological differences between *napi* and *bryoniæ*. There are only two, in some populations also three, imaginal color differences; no visible differences exist in the larval stage and some slight and inconstant ones are present in the pupal stage. This is a far lower number of distinguishing characters than usually found between sympatric species, including Pieridæ; *e.g.* the closely related and very similar species *P. rapæ* and *P. manni* differ in as many as 24 structural and color-pattern characters. (Of course, this does not mean that there are as many different genes controlling these characters.) In contrast to the minute differences between *manni* and *rapæ* the differences between *napi* and *bryoniæ* are very conspicuous. If the two or three characters in *napi* and *bryoniæ* were so inconspicuous as those between *rapæ* and *manni* the former two forms would never be recognized even as two subspecies.

The fact that there are no known differences in the genital armature, nor in any other structural character, is very important, for this is a circumstance rarely lacking among specific distinctions.

2) The considerable ecological difference between *napi* and *bryoniæ* is greater than can usually be found between closely related species, so that in general it keeps apart the populations of both forms. However, the effect of the ecological distinctness varies greatly in its control over reproductive isolation, since it depends too much on environmental circumstances. This is shown by the great difference in the reproductive isolation between *napi* and *bryoniæ* populations of the northern and the southern Alps, since in the former district *napi* and *bryoniæ* behave as good species, in the latter, however, nearly as subspecies.

3) Sexual isolation is only half-way developed, because of the discrimination in the instinctive reaction of the *napi* males to the yellow female color stimulus. This must lead, along with the lack of spatial isolation, to frequent hybridization but not more than to about 33%. This percentage, however, surpasses manyfold what is know about sexual isolation between perfectly distinct pierid species; even between such closely related species as *P. rapæ* — *P. manni, P. manni* — *ergane, P. ergane* — *P. napi* the females always obstinately refuse the assaults of strange males, making hybridization by natural ways impossible. The index of reproductive isolation between these species is approximately 1.0. Also, among about 470 individuals of *Leptidea sinapis* and *Leptidea morsei* originating from their sympatric range near Zagreb only one suspected individual could be considered as a possible hybrid, and another one perhaps also as somewhat alike; hence the index of reproductive isolation would be 0.9957 or = 1, *i.e.*, the highest degree of isolation.

4) The incomplete sexual isolation between *napi* and *bryoniæ* concords well with the great amount of hybrids in nature, especially in lowland populations where *napi* and *bryoniæ* overlap widely. Moreover, an unexpectedly high percentage of genotypicaly hidden hybrids were also found among the high alpine *bryoniæ,* mostly considered to be a pure-breeding population. All this surpasses by far the ordinary unremarkable share of the hybrids in populations even of very closely related sympatric species.

5) Although the F_3 hybrids of *bryoniæ* × *napi* are of a very good vigor and with apparently normal production of spermatozoa and eggs, their fecundity is greatly reduced or even gone when they mate together. Since the F_3 hybrid sterility is doubtless a characteristic of species

hybridization, *bryoniæ* and *napi* should be considered as separate species. However, the high fertility of the F_3 hybrids in back-crosses does not agree with what commonly occurs in species hybridization. My pierid crosses between the well known species or genera: *Pieris rapæ* × *P. napi*, *P. manni* × *P. napi*, *Pontia daplidice* × *Synchloë protodice*, *Euchloë belia* × *Anthocharis cardamines* yielded hybrids with degenerated gonads and germ cells, so that the hybrids were completely sterile in $F_1 \times F_1$ matings as well as in back-crosses. Nevertheless, the crosses between the closely related intrageneric species *Pieris rapæ* × *P. manni*, *Leptidea sinapis* × *L. morsei*, *Anthocharis cardamines* × *A. euphenoides* are also completely infertile when mated with each other, although their production of gametes seems to be normal, except the disturbed chromosome pairing and distribution in meiosis. But it is significant that the back-crosses with the parental species were almost completely sterile too, as a rather great number of (*rapæ* × *manni*) ♂ backcrosses gave rise to only one, two, or three offspring of reduced viability and no fecundity. The other two hybrids were also in the backcrosses entirely sterile. There is only one case as yet known from the pierid crosses, *Pieris ergane* ♀ × *P.* (*napi* × *bryoniæ*) ♂ which produced a F_2 generation — true for a few individuals only — and a successful backcross. However, although *napi* and *ergane* are in their anatomical structure extremely similar, their sexual isolation is complete.

This short comparison of the *bryoniæ* - *napi* case with other pierid crosses shows that the reproductive isolation between *bryoniæ* and *napi* is at such a low level that neither the partial sexual barrier, nor the decreased hybrid fertility and the ecological distinctness, may prevent a considerable gene flow, greatly surpassing any usually known to occur between species of this family. On the other hand the breeding is also far from being panmictic (with the isolation index = 0), so that the relation between *napi* and *bryoniæ* cannot be classificed as a subspecific one, either. Strangely enough, experimental crosses between subspecies of Lepidoptera are rather scarce, so that we are not able to give a good comparison of our case with other crosses between subspecies of a single species. This is not surprising if the difficulties of getting breeding material from afar are taken into account. Therefore we must content ourselves with the well known assumption that there are usually no barriers, neither sexual nor those of hybrid sterility, to crossing among races. Of course, there are exceptions to this, but one wonders whether in those occurences borderline cases are involved.

We must, therefore, conclude that our analysis gives us no strong support for the classification of the *napi* and *bryoniæ* as either two species

or as subspecies. They are at the typical transitional stage between the subspecies and the species. Such transitional stages in butterflies had been called "semispecies" independently by Kiriakoff (1948) and myself (1953, 1955, 1957). Each attempt to classify *bryoniæ* as a species or subspecies has not dealt with reality, but rather has tried to insert the different stages of speciation into a rigid system which cannot apply to refined taxonomy which fits adequately various evolutionary problems.

Summary

1. *Pieris napi* L. and *bryoniæ* Ochs. differ morphologically in three groups of alleles of which the allele *B* for the melanic *bryoniæ* pattern is dominant over the allele *b* for *napi,* and the allele *W* for the white color of the underside of the hindwings is dominant over yellow, *w*. The brownish yellow color of *bryoniæ* females is not entirely dominant over the white one of *napi* and is probably multifactorial.

2. The restriction of *bryoniæ* to the Alps, Carpathians, and the northern parts of Europe, Asia, and North America is connected with genetic ecological preferences for low temperature and certain food plants as well as to univoltinism. This ecological distinction is the principal reproductive barrier between populations of *napi* and *bryoniæ*.

3. The effect of ecological distinction on reproductive isolation depends greatly upon the climatic conditions; these are more effective in the northern Alps than in the southern, and in the latter hybrid populations are the rule.

4. The partial breakdown of ecological isolation leads to extensive hybridization, the sexual isolation being restricted mainly to the *napi* males, which are less attracted by the yellow *bryoniæ* females.

5. The third partial isolating machanism is the infertility of the F_1 hybrids which is particularly high in inbred F_1 matings, lesser in matings between different F_1 strains, and low in back-crosses.

6. Accordingly, a comparatively great amount of gene flow between the populations of *napi* and *bryoniæ* occurs in districts where the populations are not kept apart by the ecological barrier. This gene flow surpasses very greatly that between other closely related sympatric species of Pieridæ which have been studied in Europe.

7. Consequently, *bryoniæ* can by no means be considered as a true species but only as a transitional stage between subspecies and species; such incomplete stages of speciation can best be denoted as SEMISPECIES.

ACKNOWLEDGMENTS

I am greatly indebted to Dr. WILLIAM L. BROWN, then of the Museum of Comparative Zoölogy, Cambridge, Massachusetts, and to Dr. CHARLES L. REMINGTON, Department of Biology, Yale University, for critically reading this manuscript. The field research was in part supported by the Veterinary faculty and the Rectorat of the University of Zagreb.

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BUTTERFLIES AT LIGHTS

L. S. PHILLIPS's note concerning *Nymphalis j-album* Boisduval & Le Conte, and *Pieris rapæ* L. at lights, in vol.15: page 101 of the *Journal*, attracted my interest considerably. The reason for this is that at that time I had taken a butterfly at a light. Since then I have taken three more.

The first instance was the capture of a male *Strymon liparops* LeConte on the screen door of my home in Petersburg, N. Y., late in July 1961 around 10:30 in the evening. The fluorescent light was on inside, as was the incandescent light on the porch; and as I stood there capturing moths at the outside light, this *Strymon* flew in and landed on the screen door.

The second occurrence involved a female *Hamadryas februa* Fruhstorfer. The place was the Hotel Valles, Cd. Valles, S. L. P., Mexico. There at about 10 p.m. on July 31, 1962, as I was returning past a previously investigated outside light bulb in my rounds for moths, I discovered this *Hamadryas* quietly clinging to the ceiling about a foot from the bulb itself. It was a moderatly strong bulb, but the yellow walls of the outside corridor where it was located increased the area of brightness considerably.

The third occurrence was the following night at 10:30 p.m., and like the first it involved a screen door also. This time it was at a house in McAllen, Texas, involving a male *Libytheana bachmanii* Kirtland, a species which was particularly abundant there at the time. I had just stepped outside for several minutes, and when I returned to enter the house there was this *Libytheana*, apparently attracted by the incandescent light inside.

The most recent instance was yet a fourth species at a still different location. Just before 10 p.m. on August 9, 1962, I did a double-take when I looked up at the porch light of my parents home in Kingston, Pennsylvania. We had just greeted some visiting friends goodnight after talking on the porch for 15 minutes or so, and with the natural instinct of the collector I glanced up at the light bulb in the ceiling to see if there were any moths. This time it was a female *Speyeria cybele* Fabricius quietly clinging to its perch there on the ceiling within two inches of the bulb.

All four specimens are in slightly worn condition.

What to me in 1961 seemed like an interesting curiosity, must be of much more frequent occurrence than is generally observed, at least by the entomologist.

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COLIAS ACTIVITY IN NOVEMBER AND DECEMBER IN PENNSYLVANIA

by Arthur M. Shapiro

In the past few years of collecting in and around Philadelphia, Pa., I have repeatedly observed and taken specimens of the Common and Orange Sulphurs (*Colias philodice* Latreille and *eurytheme* Boisduval) in the months of November and December, long after all butterflies save the hibernating nymphalids have disappeared. The circumstances surrounding the appearance of butterflies in so unlikely a season are quite interesting.

Both species of *Colias* are extremely abundant here, and as is usual for very numerous species it is fairly difficult to distinguish broods. There appear, however, to be four, centered in late April – mid May, late June – early July, late July – mid August, and September – early October. The late November – December specimens, while fairly numerous, do not approach in abundance even the smallest of these regular broods, that in early spring. Furthermore, they do not appear to be holdovers from the early fall brood. An occasional very worn specimen of either species has turned up as late as Nov.26, and these I unhesitatingly assign to the fourth generation. But the great majority of the late season specimens are very fresh. They consist largely of "ariadne"-type *eurytheme* of both sexes, with some white females, and a considerably smaller number of *philodice*, both sexes, also with some white females. These specimens all show very heavily dusted hind wings beneath, and in the females above as well, with very narrow black borders in the males (especially reduced in *philodice*). The discocellular spot of the hind wing is very large and brightly colored in female *eurytheme*, and sometimes is enlarged in a "point" as in *C. hecla*. The specimens are generally small, and a few are quite diminutive. In general, they resemble very closely specimens taken in the month of April.

The appearance of these individuals in late fall coincides with the second or third day of a spell of milder, sunny weather. For example, in 1961: the September brood was definitely on the wane by October 29, with only a few, rather worn specimens taken. Despite unseasonably mild weather following, with a record-breaking 80°F. on November 5, only scattered, quite worn *Colias* were noted. After a brief cold spell

warm weather returned in the period from the 12th to the 16th, but only one specimen, again a worn one, was observed. An inch of snow fell on the night of the nineteenth. No specimens were observed from then until the 26th. It had been mild for two days, and on that date, with temperatures of 59°-32°, 17 fresh specimens were taken. These were the first fresh *Colias* taken since October 25. It got cold again the next day with the highest temperature for the week 50° on both the 2nd and the 3rd. On the first day two male *eurytheme* were taken, and on the following day, twelve specimens, consisting of three male and four female *eurytheme*, two male and one female *philodice*, and one white female of each. Again, all were quite fresh. Bad weather, but with continued mild temperatures, occurred for the next two days. The last captures for the season were made on Dec. 6. They consisted of four male *eurytheme* and two females, one of which was white. The overnight low for the 6th was 25° and despite a high of 45°, diligent searching failed to turn up any *Colias* on the 7th. Following that date the only mild temperatures have occurred during rainy spells, with all clear days quite cold and sub-freezing temperatures each night. No sign of butterfly life has been evident although the collecting area has been frequently examined.

All of these notes refer to one locality. The earliest fresh emergents of the fourth brood were noted there in early September, reaching their peak about Sept.23. This means that it is altogether possible that the offspring of these butterflies could be capable of emerging in late November or December. For example, in frequent breeding, the writer has observed that for *C. eurytheme* the average duration of each stage is as follows: egg, five days; larva, eighteen days; pupa, seven days. Of course, the emergence from the pupæ is ordinarily delayed until spring. The only plausible explanation for the appearance of these butterflies is that they are in reality part of the same brood as those that will appear the following April from the overwintering pupæ. That some of these pupæ may have developed to a fair extent during warm weather in October and early November, so that brief mild spells later on permit them to mature and emerge as butterflies, seems quite probable. The writer has taken Sulphurs as late as Dec.16, 1959 (the latest record known to me in the North) (temperatures 62°-36°). Any records of this sort, especially with information concerning the weather at and preceding the time of collection, would be appreciated by the writer.

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OBSERVATIONS AND RECORDS OF BUTTERFLIES ATTRACTED TO LIGHT IN INDIA

by JULIAN P. DONAHUE

Recent papers by THRONE (1961), ANDERSEN (1960), and MATHER (1959) have recorded observations of North American butterflies attracted to light at night. This paper will present new observations of Indian butterflies attracted to light, along with a brief summary of previous records. Six species of six different families are discussed.

J. I. ALFREY states in a paper by BEST (1951) that he observed *Papilio demoleus demoleus* Linnæus (Papilionidæ) frequenting "Kitson oil lamps" at night, at the railway station in Jhansi (southern Uttar Pradesh State, north central India) during a migration. No date or other information was given. This species is very common throughout India, but is normally seen only in the daytime, and I have never seen it active in the evening.

USMAN (1956) records *Talicada nyseus* (Guérin) (Lycænidæ) as being attracted to light sometime during March-May, 1955 in Bangalore (Mysore State, south India). The number of individuals attracted was not mentioned. Though this species is not common, WYNTER-BLYTH (1957) says it is locally abundant. He further states that it is a weak flyer, prefers shade to sunshine, and keeps on the wing until almost dark.

BEST (1956) mentions that a *Gangara thyrsis* (Fabricius) (Hesperiidæ) flew into his flat on Malabar Hill, Bombay (Maharashtra State, west coast) at 9 p.m., and settled on a lamp where he caught it with his fingers. The date was between early February and the end of June, 1956. WYNTER-BLYTH (1957) states that this large skipper is crepuscular – resting during the day but being active shortly after dawn and again at dusk.

In New Delhi, India, on October 1, 1961, I collected two *Danaus chrysippus* (Linnæus) (Danaidæ) at night. The first, a female, was collected at 11:05 p.m. When first noticed the butterfly was flopping about our 150 watt porch light, as a slow-flying moth would. When I returned with my net it had lit inside the shade of the light, and was less than four inches from the light. It flew out again and I had to net it in the air. It was a very "buggy" night – mostly Orthoptera and very few Heterocera. Temperature was 80°F.

At 11:30 p.m. on the same night, a male *Danaus chrysippus* was flopping about on the floor of our back porch, which was illuminated by a

TOP ROW: left, *Papilio demoleus,* New Delhi, India; right, *Danaus chrysippus* ♀, collected at light in New Delhi on 1 Oct. 1961.

BOTTOM ROW: left, *Melanitis leda,* form "determinata", underside, collected at light in New Delhi on 29 Aug. 1961; right, *Precis orithya* ♀, collected at light in New Delhi on 17 Nov. 1961.

(Scale numbered in centimeters. Photograph by the author)

60 watt bulb. When it was not flopping it rested on the floor, slowly opening and closing its wings. I let it crawl onto the rim of my net and held it up to the light, but the insect only walked slowly around the rim of the net. I nudged it off and it spiraled back down to the floor, apparently not so strongly attracted to the light as the female. Both specimens were in near perfect condition. This species is one of the commonest butterflies of the Indian plains. WYNTER-BLYTH (1957) says it flies from dawn to dusk.

On November 17, 1961 at 4:40 a.m. I saw a female *Precis orithya* (Linnæus) (Nymphalidæ) resting motionless on the floor of the front porch in New Delhi, about eight feet away — in a direct line — from the 150 watt light. It was easily caught and was not very active. Temperature 60°F.

While I drove through desert scrub at night with a spotlight, about 50 miles south-southwest of Pali, Rajasthan State (northwest India), on October 6, 1961, a *Precis orithya* flew into the open Jeep, where it was caught and identified. But this specimen had obviously been disturbed by the passing vehicle, and happened to fly inside. It is a very common species that has a strong preference for sun and desert or dry areas.

The greatest number of records I have for the nocturnal occurrence of a single species, however, is for *Melanitis leda* (Drury) (Satyridæ). On August 29, 1961 a very active *M. leda* (wet season form "determinata" Butler) was netted as it fluttered around our New Delhi porch light. On August 31, 1961 another specimen was seen on our porch, but it was too active to capture (it persisted in settling at the base of the ceiling fan, about 15 feet up). On September 24, 1961 a *M. leda* form "determinata" was seen on our New Delhi porch at 11:30 p.m. It was about one foot from a 60 watt bulb, hanging upside down from the ceiling. When I failed to catch it with my fingers it left its resting spot and flew around the bulb, then spiraled below the bulb, rapidly rising, falling, and circling just as a disturbed and confused moth would. It abruptly landed and I caught it. The temperature was 81°F., the moon full, and the night was damp and dewy (it had rained in the morning).

On November 2, 1961 two *M. leda* (wet season - dry season transition forms) were observed flying around our New Delhi porch at 5:47 p.m. (just 12 minutes after official sunset). I turned on the 60 watt light and one of the individuals immediately flew to the light. By 6:00 p.m. both individuals had settled near the light (both were about 50 inches away). The temperature was 67°F. at this time. Periodic observations were made until 12:45 a.m. the next morning, when the temperature had dropped to 64°F. One individual remained stationary in its original position throughout the period of observation. The other was inclined to change positions more frequently: at 6:21 p.m. it was 21 inches from the light, at 6:22 p.m. it moved to within 12 inches of the light, and at 11:42 p.m. it was about 14 inches from the light. By 10:00 a.m. the next morning both butterflies were gone.

Finally, on November 28, 1961 I collected a *M. leda* (dry season form "ismene" Cramer) at 9:50 p.m. at Karwar, Mysore State (west

coast). The insect was flying around a rather dimly lit porch and was very active. The Arabian Sea was about 150 feet away.

Melanitis leda is common throughout India, but is strongly crepuscular in its habits. It only begins flying at dusk, and I have often watched numbers of them flying about until it was too dark to see them any more. WYNTER-BLYTH (1957) said that this species is " . . . so common in certain areas as to be a nuisance around lights in the evening" (page 123).

SUMMARY AND DISCUSSION

Only a few general observations and comments can be made at this time. It will be noted that three of the species discussed (*Papilio demoleus, Precis orithya,* and *Danaus chrysippus*) are normally sun-loving species and retire at dusk, while crepuscular activity is recorded as normal for *Gangara thyrsis, Talicada nyseus,* and *Melanitis leda.* However, it appears that some of these last three crepuscular species (especially *M. leda*) are more active at night than the three sun-loving species. In other words, from the data available it appears that crepuscular species occur more frequently at lights, which is what one might be led to suspect.

Most of the observations that were accurately dated (*M. leda, D. chrysippus,* and *Precis orithya*) were made either during or soon after the rains of the southwest monsoon (about mid-June to mid-September), when the majority of annual rainfall occurs in India. However, I have not had the opportunity to make observations during the spring and dry season (around February to June). It might also be noted that in arid areas, where my observations were made (New Delhi), butterfly numbers are greatest during the monsoon season, when there is an abundance of food. In this instance, therefore, the population peak coincides with the rainy season, and either one or both of these factors may influence the activity of certain species at lights.

For *M. leda,* the temperatures at time of attraction to lights ranged from 64°F. to 81°F., a spread of 17 degrees. However, from November 2, 1961 until the preparation of this paper (early February, 1962) I have not recorded any species attracted to our house lights in New Delhi. This is the winter season; the temperature between 10:00 p.m. and midnight is usually between 45° and 50°F., and may drop to near freezing before morning. A check of the immediate neighborhood has shown that the three species for which I have recorded observations do not appear to be present during the winter as active imagines. Tempera-

ture probably has some effect upon the nocturnal activity of the species in question.

THRONE (1961) suggests that a butterfly may fly to a light if it is disturbed at night, and is near the light in the first place. This may be so in some instances, but in other cases the butterfly probably would have to expend some effort to reach the light. For example *Gangara thrysis* flying into a room, and most of the butterflies observed on our porch – *Precis orithya, M. leda,* and *D. chrysippus* – which would have had to have flown over 50 feet, over a hedge, from the nearest spot that these species normally frequent. Granted, they may have settled on the property at dark, but in that case the only thing to disturb them would have been an occasional cat.

Further observations and experimentation will undoubtedly aid in the interpretation of this interesting phenomenon. A thorough search through literature on Indian Lepidoptera may produce further obscure references to butterflies being attracted to lights at night.

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NOTE REGARDING HABITATS AND RHOPALOCERA OF DONNER PASS, CALIFORNIA

In our previous paper (Emmel & Emmel, 1962) on the Donner Pass butterfly fauna, we unfortunately omitted a description of the fourth plant association in the *Dry-Meadow* habitat. This association, called here the Lake Mary road area, is listed in Table 1 and shown in Figure 2 of that paper; the following remarks should be added after the "Summit Valley" description (1962: p.28):

2-D. LAKE MARY ROAD

This is the dirt road from Donner Summit (Highway 40) to the Sugar Bowl Lodge; it passes by Lake Mary and parallels the railroad snowsheds. The area (elevation 7000 feet) is generally dry and covered by chaparral-like plant growth. Typical plants are *Ceanothus* and buckwheat (*Eriogonum*), with a few willows (*Salix*).

A FURTHER NOTE: Because of the identical butterfly faunas of the two sub-habitats listed under "*1. Wet Meadow*" (1962, p.27), the data concerning the two faunas were combined in one column (Habitat "1") in Table 1 (1962, p. 37-38).

We thank Dr. C. B. Williams for bringing these points to our attention.

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SONG SPARROWS FEEDING ON LEPIDOPTERA

For the past few days, June 4th through 7th, 1962, I have noticed the common Song Sparrow, *Melospiza melodia,* hawking insects here. Upon closer inspection it was ascertained that very often the insects were lepidopterous. Many moths (I am not able to identify moths) were taken. Several *Everes comyntas, Strymon, Lycænopsis argiolus,* and *Lycæna phlæas americana* were also ingested by the sparrows.

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ESPECIALLY FOR FIELD COLLECTORS

(Under the supervision of FRED T. THORNE, 1360 Merritt Dr., El Cajon, Calif., U.S.A.)

A LITTLE ABOUT THE LITTLE-KNOWN *PAPILIO INDRA MINORI*

by DONALD EFF

In July of 1937, the Colorado Museum of Natural History published as Volume XVI, Number 1 of their *Proceedings* a small check-list of "Butterflies of Colorado" by FRANK CLAY CROSS. In this check-list CROSS listed 241 species, including two new subspecies, one of which he named *Papilio indra minori.*

Inasmuch as this 28 page pamphlet of "Butterflies of Colorado" has long been out of print and few collectors have seen or read the original description of *Papilio indra minori,* I should like first of all to repeat it here.

"Differs widely from typical *indra* in having well-developed tails on the secondaries, and narrower primaries; and from *pergamus* by a great suppression, or total absence in some specimens of the yellow median bands on the wings, as well as by an invariable absence of any yellow at all on the abdomen. Typical *indra* submarginal band on the under side of fore wings.

"This butterfly, which was discovered by Mr. W. C. Minor of Fruita, Colorado is known to occur only in a small area called the "Black Ridge Breaks", in Mesa County. It flies for about two weeks in late April or early May. No second brood.

"Holotype and allotype in the author's collection in the Colorado Museum of Natural History; thirteen paratypes."

The foregoing is not what could be termed a very detailed description. However, since my purpose in writing this article is not to discuss differences or similarities, suffice to say that it is a very distinct subspecies, easily recognizable. What I do want to do is tell a little about the distribution, history, and an unusual characteristic of this rarity.

Papilio indra minori, since the date of it's description, has always been regarded, and rightfully so, as one of the rarest of all North American butterflies. There are several reasons for this, the most important one being it's extremely limited locale. Add to that the inaccessibility of this locality and the fact that there is only one collector in that entire section of the state, and that he is no longer very active in the pursuit of Lepidoptera, and the reason for the scarcity of this butterfly in collections is apparent.

The type locality, referred to in the original description as the "Black Ridge Breaks", would indicate that it was generally found throughout the canyons and cliffs bordering Black Ridge. Actually, until 1959 the only known locality was a place called Coal Mine Point on the northwest side of Black Ridge, and here the butterfly was found only along the Ridge, west from Coal Mine Point for a distance of about one-fourth of a mile. This "home" of *minori* is now isolated! Nature has provided the safeguards on three sides and man has barred the only logical entrance. On the two sides of the mesa closest to the type locality, the edge of the mesa is cut by fantastic, red-walled canyons. Most of the canyon walls are perpendicular and impassable for anything except birds. To the south the mesa, after extending for many miles from the type locality of *minori* drops off more gradually into Glade Park. However, the distance from the south through miles and miles of farm land, and then many miles more across the pinon and sagebrush of Black Ridge precludes the possibility of entrance from that direction.

Black Ridge is used mainly for the grazing of sheep and some farming. One large sheep rancher owns or leases nearly the entire Ridge, and three or four others own out-lying portions and adjacent land. It is interesting to note that in the beginning these ranchers never locked the only gate permitting access to Black Ridge. Then the government moved a radio-sonde beam station to Black Ridge. About the same time the Colorado Highway Patrol built a short wave station there, and now the Denver & Rio Grande Railroad has done the same. The officials decided to lock the gate to discourage visitors, and keys are issued only to persons who have business there. If perchance you are fortunate enough to know someone who can gain you admission, then you are faced with a maze of dirt roads leading in all directions. Nearly all of these are merely tracks through the sagebrush and all, of course, are unmarked. One leads to Coal Mine Point, and another leads to the western edge of the mesa where the old Ute Trail drops from the mesa into the labyrinth of canyons bordering the Colorado River. Here, in 1959 MINOR saw two specimens of *minori,* the first seen out side of the Coal Mine Point area. In mid-May of 1961 DAVID L. BAUER and I spent the second of two days exploring this western edge of the mesa and found that the two specimens seen by MINOR were definitely not strays. To the contrary, the butterfly was more common here than at the Coal Mine Point locality, and we collected it for a distance of about two miles along the rim, south to the last out-cropping of rock before the mesa drops off into Glade Park. So far, these two spots, separated for a distance of about three miles where for some unknown reason the butterfly does not seem to occur although

the terrain is the same, are the only known spots where you can take it. *Papilio indra minori* normally does not stray more than a hundred yards or so from its little corridor along the side of the mesa. However, in 1961 we had a glimpse of what we thought was one as we drove the twisting road along the edge of the cliffs in the Colorado National Monument. MINOR, in a recent letter tells of seeing three strays, one in Glade Park, one in Devils Canyon, and one at the mouth of Pollock Canyon. All three were a considerable distance from "home", which causes him to wonder if it might be extending it's range.

After observing it's flight habits and the type of terrain to which restricted, and studying the country that can be seen to the south and correlating this with a map of western Colorado, we came to the conclusion that it might be found in suitable locations along the western edge of the Uncompaghre Plateau, from Black Ridge which forms the extreme northwestern tip, clear into southwestern Colorado. There is a specimen in the Mesa Verde Museum which presently represents the southernmost record of this butterfly. But to verify this possible distribution will take a lot of doing, for the western Colorado border area is known only to a few ranchers, sheep herders, and some uranium prospectors. If any transient collectors have penetrated this area, then it apparently has been at the wrong time. It is not a promising land in which to collect, but the early collector may meet with some interesting species and possible new records. To illustrate, one record omitted from *Colorado Butterflies* by BROWN, EFF, and ROTGER in their publication in the spring of 1957 was *Melitæa,* or as it is now known *Chlosyne, acastus.* The fact that MINOR had taken this commonly in the 30's and 40's was overlooked until Dr. HUGO RODECK of the University of Colorado Museum captured the species in the Colorado National Monument between Grand Junction and Fruita. Since then I have taken it each time during the last three trips. In addition I have found *Euchloe creusa,* previously recorded only from southern Colorado, added to the few records of *Atlides halesus,* and most interesting of all, captured specimens of *Anthocaris* that seem referable only to *inghami.* The southern areas adjacent to Black Ridge look inviting and I'm hopeful of collecting on Pinon Mesa and in the Gateway areas in the near future to see if *minori* can be located there. The outlook for Pinon Mesa is remote however, for Mr. MINOR spent fifteen summers there without seeing one but agrees that the Gateway area is a possibility. [Since this article was submitted for publication, SCOTT ELLIS, of Hotchkiss, Colorado, took one specimen in Delta County, approximately 80 miles south of Black Ridge.]

Now that I have noted its scarcity, and the reasons why, here is a word or two about the number of specimens known to have been collected. As mentioned in the original description, it was described from fifteen specimens, all supplied by W. C. MINOR, and at the time all in the Colorado Museum of Natural History. Since that time it is estimated that Mr. MINOR has probably put into circulation about two dozen additional specimens. Most of these were taken in the 1940's; since that time he has not collected very actively. In 1947 the two ACKERMAN boys reputedly took 26 specimens, most of which were in very poor condition. Aside from these records, I feel extremely fortunate to have captured 26 specimens, 10 of these this past May when DAVID BAUER also took eight specimens. It is probably safe to say that not over 100 specimens have ever found their way into collections. To take my 26 specimens has required five round trips of approximately 600 miles, which means that I drove about 115 miles for each specimen! In 1952 my trip was fruitless, in 1956 I took one (the only one seen), in 1959 I got nine in two days of collecting, in 1960, six in an afternoon and a morning, and in 1961, ten specimens in two full days, including the first female I've ever seen in the wild. Incidentally, I strongly suspect that when the food plant is determined, it will turn out to be *Lomatium grayi* (C. & R.). This conclusion was arrived at by the process of elimination of the plants found in *minori's* restricted locale. *Papilio minori* never seems to visit any flower other than Service-berry, but seems to prefer to alight in the few rocky areas where water has washed away the soil.

I mentioned that I had captured 26 specimens of *minori*. I've taken close to twice this number, but have released at least half of those captured, and probably should have released more. Actually, I've captured six *good* specimens, and herein lies the clue to the strange characteristic which makes it so difficult to get decent specimens, once you've cleared all the other hurdles. Among the butterflies with which any of you are familiar, are a few that are pugnacious in character . . . but here's one that is actually ferocious! In the beginning MINOR was of the opinion that his inability to ever capture a perfect specimen was caused by the wind that blows almost constantly across the high mountain ridge that is home to this butterfly. He thought that the rubbed and torn wings were the result of the battering by wind. Then one day he found the real reason and tells about "Belligerent Butterflies" for a complete chapter in his delightful and authentic nature book entitled *Footprints In The Trail.* He recounts how one day he had climbed the slopes of Black Ridge and stopped to rest in the shade of a stunted piñon. It was a warm and pleasant day and the air was filled with the singing of birds

and the hum of bees and other insects. He heard a faint clicking sound, but paid little attention until a tiny shower of fine, black dust sifted down through the branches of the tree beneath which he was resting. Then he looked up to see a ferocious life and death struggle going on only a few feet above his head between two butterflies. The faint clicking was made by their wings as they dashed back and forth, circling, flitting up and down, and occasionally crashing full tilt into each other, and the shower of black dust was of course, the tiny scales brushed from their wings during battle. Butterflies are usually associated with gaiety and frivolity, lightheartedness and beauty, and not thought of as ferocious creatures with murder in their heart and a desire to liquidate another of its own kind. Yet it was easy to see that these two were in deadly earnest for they were slugging and hammering away at each other until their wings were battered and torn and the scales worn from their wings. In succeeding years he observed numerous other bouts between these butterflies, and arrived at the same conclusion as anyone else who has observed them, that this is the real reason why it's almost impossible to capture perfect specimens. He recounts in his book in the chapter devoted to this butterfly, how he was offered $25 each for up to four pairs of perfect specimens, and how he and another collector friend spent a day on Black Ridge pursuing *indra minori*. They had gone earlier in the season than usual to insure getting fresh specimens if any were to be taken. Upon arrival they found two specimens flitting about over a serviceberry patch. The brush was too thick to wade through and so they had to be content to remain along the edges and swing at the specimens anytime they ventured near enough to the edge of the patch to be within reach. Whenever they did alight just beyond reach, and sit for a few minutes so that they could be observed, it was readily apparent that these were freshly emerged, "perfect" specimens, the kind the museum wanted and they had dreamed of finding and capturing. Both collectors were full of enthusiasm but as the hours slipped by and they were unable to capture these two specimens their joy was mixed with first disappointment, and then despair. Then later in the afternoon two more *minori* suddenly appeared over the same berry patch, and almost instantly the battle was on. Now instead of winging lazily about over the patch they dashed furiously back and forth, crashing into each other, and soon a fog of black dust began to settle down, and then pieces of wings, while the two collectors stood helplessly by and watched a hundred dollars worth of butterflies being torn to bits before their eyes. Then all of a sudden the butterflies were gone, but shortly one of them returned and flapped slowly by and was now easily netted.

Examination showed that its wings were so tattered and torn and badly rubbed that they were almost transparent in places. The tips of both forewings were broken, and one wing was torn down its full length Half of one of the hind wings was gone. It had lost a leg and an antenna. It was worthless. The collector with Minor had worn a new $10 hat that day to protect his hairless head from the sun, but by now he was so infuriated that he threw it to the ground, stomped on it in anger, then jammed it on his head, only to change his mind and with a snort of disgust, removed it and sailed it off the edge of the mesa, and headed for home with his bare head gleaming in the afternoon sun.

My own personal observation of the intensity with which this butterfly does battle was not until 1959. In May of that year I spent two full days in the vicinity of Coal Mine Point collecting *minori*. On the second day as I was stalking a specimen, another sailed by and the first instantly arose to do battle. Almost immediately they were locked together, beating and tearing at each other and oblivious to everything else. They fell to the ground and I clamped the net over them, but even this had no effect as they continued to do battle. It was actually necessary to forcefully separate them, and of course both were ruined. That year I took 17 specimens. I released 8, and of the remaining 9, used parts of two of them to patch 5 of the others that they might somewhat resemble whole specimens. Only two specimens were in good shape. Apparently they were the only ones that had not already engaged in battle. In 1960 I was again treated to the same spectacle where two of them engaged in battle, and even after crashing into each other, then locking in combat and falling to the ground, proceeded to roll over and over as they attempted to outdo the other. This time I was fortunate enough to rescue one before he was too badly beaten, while the other was already a wreck. This past May, David Bauer who was a complete stranger to this butterfly and its ways, was fortunate enough to observe this war-like tendency, and commented upon the savageness of an encounter between two specimens. I had not forewarned him of this characteristic, so it was interesting to have his unsolicited corroboration of the fact that this graceful, elusive creature is undoubtedly the pugilistic king of the butterfly world when given an argument by another of its own kind.

R.1 Fairview Estates, Boulder, Colo., U. S. A.

OVER ONE HUNDRED BUTTERFLY SPECIES CAUGHT IN A SINGLE DAY (3rd JUNE 1961) AT MUSSOORIE, INDIA

by ERNEST M. SHULL

Catching butterflies along an Himalayan mountain stream is a rewarding and exciting experience. The hill station of Mussoorie in northwest India is probably one of the best places in the world for collecting a large number of species. On June 4, 1957 a small party caught sixty-eight species in Mussoorie (Shull, 1958). This represented a record catch during our seven years of collecting in Mussoorie. Frequent field trips to the gardens, waterfalls, and streams in Mussoorie have confirmed the view that the largest number of species comes early in June before the heavy monsoon.

On June 3, 1961 another small party, consisting of three adults (GLENN CAMPBELL, THOMAS COWART and myself) and four boys (DEAN FASNACHT, PHILIP CAMPBELL, JIM and DANNY SHULL) left from our rest house at Prospect Point (alt. 7381 ft.) for the famous Pumping Station (alt. 5600 ft.). From 8:00 A.M. to 10:00 A.M., when collecting is usually limited to a few browns (Satyridæ) and skippers (Hesperiidæ), we hiked down the mountain to the stream. The two older boys, DEAN FASNACHT and JIM SHULL, took a slightly different path passing through the Mussoorie Municipal Garden (alt. 6535 ft.). Here they caught a variety of skippers and two species of clouded yellows, *Colias electo* and *C. erate.*

The majority of species were netted between 10:00 A.M. and 3:00 P.M. at the Pumping Station nullah from an altitude of 5600 ft. to 5300 ft. One hundred and one species were caught and preserved, and four more species were observed but not captured; namely, *Hypolimnas bolina* ♀, *Papilio machaon, Terias hecabe* and *Limenitis trivena.*

During the day I caught seventy-four species. My son, JIM, caught sixty-six species, adding thirteen more species to the list. DANNY, my youngest son, caught fifty-one species and added eight more to the list. Mr. CAMPBELL caught fifty-three species and contributed four more species to the total list. The two species of yellows (*Colias electo* and *C. erate*) were captured by DEAN FASNACHT. Mr. COWART was an observer on the trip, catching a few butterflies and enjoying the mountain scenery. The day was favorable with its warm sunshine and absence of rain, wind and clouds. By June 5th the rains came and the butterfly population was greatly reduced both in numbers and in the variety of species.

The following is a list of the one hundred and one species collected on June 3, 1961 in Mussoorie:

DANAIDÆ: *Danaus genutia, D. aglea, D. limniace, Euplœa core, E. mulciber* (5 species).

SATYRIDÆ: *Mycalesis lepcha, Lethe rohria dyrta, L. verma, L. sidonis, L. yama, Erebia nirmala, E. annada, E. scanda, Ypthima avanta, Y. nareda, Y. asterope, Melanitis leda, M. zitenius, M. phedima, Pararge schakra* (15 species).

NYMPHALIDÆ: *Sephisa dichroa, Stibochiona nicea, Pantoporia opalina, P. asura, Neptis hyla, N. sankara, N. ananta, N. zaida zaida, N. mahendra, Cyrestis thyodamas, Pseudergolis wedah, Kallima inachus, Precis lemonias, P. orithya, P. iphita, Apatura ambica, Euthalia patala, Vanessa cardui, V. indica, V. canace, V. cashmiriensis, Atella phalantha, Symbrenthia hippoclus, S. hyselis, Limenitis danava, Diagora persimilis* (26 species).

ERYCINIDÆ: *Libythea myrrha, Dodona durga, D. dipœa, D. eugenes, D. egeon* (5 species).

LYCÆNIDÆ: *Lycænopsis vardhana, L. puspa, L. huegelii, Polyommatus astrarche, Zizeeria trochilus, Z. otis, Jamides bochus, Lycæna pavana, L. phleas, Heliophorus sena, Euaspa milionia, Thecla ziha, T. syla, Lampides bœticus, Chætoprocta odata, Amblypodia ganesa, A. dama, A. dodonea, A. amantes, Spindasis nipalicus, Pratapa icetas, Chilades laius, Rapala nissa, R. selira* (24 species).

PAPILIONIDÆ: *Papilio protenor, P. polytes* ♂ and ♀ form "romulus", *P. polyctor, Zetides cloanthus, Z. sarpedon* (5 species).

PIERIDÆ: *Aporia leucodyce, A. agathon caphusa, Pieris canidia, P. brassicæ, Gonepteryx rhamni, Colias electo, C. erate* (7 species).

HESPERIIDÆ: *Pelopidas mathias, P. sinensis, Celænorrhinus leucocera, Tagiades menaka, Suastus gremius, Taractrocera danna, Æromachus stigmata, Polytrema eltola, P. lubricans, Notocrypta feisthameli, Udaspes folus, Hyarotis adrastus, Lobocla bifasciatus casyapa, Pedesta masuriensis* (14 species).

Below the Pumping Station sewage was seeping into the mountain stream forming a stagnant, stinky pool of water. At least seventy species of butterflies and a few moths were caught near the pool. The rare Siren (*Diagora persimilis*), a pair of the Commodore (*Limenitis danava*) and the scarce Indian Purple Emperor (*Apatura ambica*) were captured with our nets. DANNY SHULL caught the only three Sirens seen during the day. A majority of the skippers were collected in the Municipal

Garden. Late in the evening, when nearing our starting place of Prospect Point, a Common Wall (*Pararge schakra*) was caught terminating our day's highest catch.

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Ahwa, via Bilimora, Dangs Dist., B. S., INDIA

ON LEPIDOPTERA ON CZECHOSLOVAK POSTAGE STAMPS

During recent years in *The Lepidopterists' News* several articles were published on the Lepidoptera on postage stamps issued in different countries of the world (Smith 1954, 1955; Wren 1955). These reports are interesting not only for the philatelists, but for the lepidopterists also. Therefore I give here a short report on a series of nine postage stamps issued on 27 November 1961 by the Czechoslovak Ministry of Transport and Communications. In this series are figured 8 species of butterflies and one moth occurring in Czechoslovakia.

All stamps were designed by the National Artist, Professor Dr. h. c. Max Švabinsky and were engraved by Jindra Schmidt. The author of these stamps is the well known Dean of Czech artists, 88-year old Professor at the Academy of Art in Prague, Dr. Švabinsky, mentioned in this *Journal* on another occasion (Moucha 1958). [He died 10 February 1962.]

By the occasion of the issue of these stamps Dr. Švabinsky proclaimed: "Before I send my butterflies out into the world I should like to give them a mission – the hope that in everyone who looks at them with a little interest they will awaken a longing to turn ever more frequently towards Nature and her beauty; for everyone who comes to her with an understanding of her language she offers a treasure trove of countless

new wonders and new miracles. For the riches of Nature, the great Comforter, are indeed infinite."

The stamps have the following species and values [100 h ("heller") = 1 Kčs ("Czechoslovak crown")]:

15 h – The Orange Tip (*Anthocaris cardamines* L.)
20 h – The Small Thais (*Zerynthia hypsipyle* Sch. = *polyxena* Den. & Schiff.)
40 h – The Swallow-tail (*Papilio machaon* L.)
60 h – The Peacock (*Nymphalis io* L.)
80 h – The Camberwell Beauty (*Nymphalis antiopa* L.)
30 h – The Apollo (*Parnassius apollo* L.)
1,- Kčs – The Underwing (*Catocala fraxini* L.)
1,60 Kčs – The Red Admiral (*Vanessa atalanta* L.)
2,- Kčs – The Brimstone (*Gonepteryx rhamni* L.).

All species are figured in natural positions on flowers or in flight. The most successful is the Apollo sitting on flowering Thistle (*Carduus*) with the mountains in the background. In the background of the Swallow-tail is the Centralbohemian mythical Mount of Říp. On the stamp with the Brimstone is the silhouette of the ruin of the historical castle "Trosky" in the region of the Czech Paradise. On the background of the other stamps there are different types of the landscapes of Czechoslovakia without the exact determination of the place.

The dimensions of the pictorial portion of the stamps are 22 × 38 mm. On the upper margin is the inscription "Československo", on the lower one there are the Latin and the Czech popular names of the figured species.

Without doubt the new issue of Czechoslovak stamps with Lepidoptera will be favorably accepted not only in Czechoslovakia but in the foreign countries also.

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JOHN CARL HOPFINGER (1888 - 1961)

June 7, 1961, marked the end of the road for one of America's best known collectors, John Hopfinger of Brewster, Washington. He was born March 30, 1888, at Kastin, Austria, and came to the United States in 1906. Here he worked at various jobs until 1910 when he made his way along a pioneer wagon road to Brewster, the town he was to know as home for his remaining 51 years. In the year 1916 he did go to Texas for five years. While there he met and married Mary Steinmeyer. The couple returned in 1921 to Brewster, where they have since resided without interruption. During John's lifetime as a resident of Brewster he was in the orchard business, and also worked as a carpenter. In the more recent years of his life he built a new Cape Cod home, which with the aid of his wife's "green thumb" was one of the loveliest homes in the area. Because he was so well known, and because people were always calling to see his collection, he converted his double garage into a private museum in which was housed not only his butterfly collection, but also his geological specimens, for he was also in later years, an avid "rock hound". He also acquired a stamp collection of goodly size.

For the present, Mrs. Hopfinger intends to retain the Lepidoptera collection, of about 20,000 specimens, and museum intact. A specialty is the *Erebia* section, with 900 specimens from Eurasia and North America.

Hopfinger started collecting butterflies as a small boy and was one of the greatest of what is sometimes referred to as the "old school". He collected butterflies because of his love of them, and not usually for some scientific purpose. However, he was never too busy to collect specific groups for the specialist or scientist, or to help some tyro collector on his way with a gift of a couple hundred specimens. The amount of material in private collections, as well as museums and other scientific institutions, collected by this man is amazing. With his demise not only did lepidopterology lose a champion, but serious collectors and collections in all parts of the world lost one of the most prolific sources of North American specimens. Anyone expressing a desire for something in particular could be assured that he would do his level best to obtain it. With approximately 50 years of collecting at the edge of the little known Cascade Range, and his many field observations, it was small wonder that his stature as a field collector was so great, or that his contributions were so many and varied. Perhaps his most famous record is his 1956 capture of the only known U.S. specimens of *Boloria astarte*. He was also the first collector to take *Œneis beani* in the U.S.A. Specialists, seeking to pay homage to his collecting prowess, have honored him by naming many species and subspecies in his honor. Among these are *Erebia epipsodea hopfingeri* (Ehrlich) and *Euphydryas anicia hopfingeri* (Gunder).

Not only do my personal recollections of John include thirty-odd years of correspondence and fruitful exchanges, but also memorable visits to the Hopfinger household; once with a fever of 103° and a severe case of tonsillitis; once when I mentioned that I had never had my fill of Bing Cherries so he took a 3 gallon pail and we went across the road and picked enough that I could never make the same claim again; and the most memorable of all, the 27th of June 1943! On that day John and his wife Mary took my wife and me collecting on Gold Creek near the site of a former C.C.C. camp. Here a broken irrigation ditch had spilled some water unto a large, flat, sandy area. *Papilio* had congregated here by the hundreds, or maybe even thousands. While our wives rested comfortably in the shade of nearby trees and operated the cyanide jars, John and I cautiously circled the sipping *Papilio* and as they arose in what at times was a virtual cloud, selected the ones we most desired, netted them and returned to the ladies and the cyanide jars. By the time the netted specimens were cared for, the disturbed butterflies would

be settled and we would repeat the process, until we had all that we wanted. Never had either of us seen such a sight, either before or after that, and I never expect to again.

Surviving JOHN HOPFINGER are his widow, MARY, of Brewster, two daughters, BARBARA SHORT of Grand Junction, Colorado, and BETTY CORNELIOUS of Aurora, Colorado, and four grandchildren.

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ON LOCALITIES OF HOPFINGER SPECIMENS

Among the several institutions for which JOHN C. HOPFINGER collected large research series of Lepidoptera is the Peabody Museum of Yale University. A few years ago I called Mr. HOPFINGER's attention to the fact that he has used the locality "Brewster" on very many specimens which my own experience in the field as his guest made me certain were actually taken at much higher altitudes. It turned out that, like many collectors, he had regularly used the nearest town to his home as the locality for specimens taken anywhere near. He provided me with a checklist of the butterfly species of his area, with notes on the true localities. We have used it to correct the data labels on many of our HOPFINGER specimens.

The purpose of this note is to record the fact that "Brewster, Washington" on HOPFINGER material should be construed to mean "Brewster, Washington, region". Brewster, HOPFINGER's postal address, is a small town on the north bank of the Columbia River in southern Okanagan County. The HOPFINGER home tract is on the south bank a few miles eastward. This is an arid locality with few native trees and with *Artemisia dracunculoides* abundant (the food of the hundreds of *Papilio oregonia* taken by HOPFINGER over the years). The following is HOPFINGER's list of his principal collecting localities in Okanagan County, with elevations above sea level:

Brewster, 900′	Hart's Pass, 6,197′
Black Canyon, approx. 1,200′	Tiffany Lake, approx. 7,000′
Alta Lake, 1,210′	Crater Lake, approx. 7,000′
Camp Gilbert, 3,527′	Slate Peak, 7,480′
Salmon Meadows, 5,400′	Cooney Mt., 8,200′
Twisp Pass, 6,066′	Tiffany Mt., 8,275′

HOPFINGER's contributions to research through specimens and correspondence field notes are very large, and he provided many of the records for B. V. LEIGHTON's *The butterflies of Washington* (*Univ. Wash. publ. biol.* 9: 47-63; 1946), but he was not an active publisher. The following are his only works in print, as far as I know:

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1949. 2. *Northwest*–Oregon, Washington, Idaho, and British Columbia, *in* The field season summary of North American Lepidoptera for 1948. *Lepid. news* 2, suppl.: iii.

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1951. 2. *Northwest*–Oregon, Washington, Idaho, British Columbia, *in* The field season summary of North American Lepidoptera for 1950. *Lepid. news* 4: 92-93.

1952. 2. Northwest–Oregon, Washington, Idaho, British Columbia, *in* The field season summary of North American Lepidoptera for 1951. *Lepid. news* 5: 88-91.

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R E V I E W

MOTÝLI [Moths, including butterflies; in Czech]. By Josef Moucha. 1962. 143 pp., 36 col. pls. Státní Dětské Knihy [State Publishing House for Children's Books], Prague, Czechoslovkia. Available from S N D K, Staropramenná 12, Praha 5, Czechoslovakia; price 18.60 Kčs.

This is a small book, intended to stimulate and guide an interest in collecting Lepidoptera. There are 15 short chapters on life history, distribution, and methods of collecting and preparing moths and butterflies and their early stages. The remainder of the book is composed of fine colored plates of Czech Lepidoptera painted by F. PROCHAZKA, each faced by a page discussing the species illustrated. The figures show adults of 91 species of butterflies and 34 species of moths, mainly Sphingidæ, Saturniidæ, and Arctiidæ.

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RECENT LITERATURE ON LEPIDOPTERA

(Under the supervision of PETER F. BELLINGER)

Under this heading are included abstracts of papers and books of interest to lepidopterists. The world's literature is searched systematically, and it is intended that every work on Lepidoptera published after 1946 will be noticed here; omissions of papers more than 3 or 4 years old should be called to Dr. BELLINGER's attention. New genera and higher categories are shown in CAPITALS, new species and subspecies are noted, with type localities if given in print.

B. SYSTEMATICS AND NOMENCLATURE

Nye, I. W. B., "A new species of Amphipyrinæ from Madagascar (Lep. Agrotidæ)" [in French]. *Rev. franç. Ent.*, vol.26: pp.50-52, 3 figs. 1959. Description of *Sciomesa biluma* (holotype from Tananarive), a species from the east and center of Madagascar. [P. V.]

Nyström, Viking, "Macrolepidoptera from the Cape Verde Islands." *Comment. biol.*, vol.17, no.7: pp.1-36, 1 table, 1 map. 93 figs. 1958. Deals with the Papilionidæ, Pieridæ, Danaidæ, Nymphalidæ, Lycænidæ, Hesperiidæ, Sphingidæ, Noctuidæ, & Arctiidæ collected by Prof. Håkan Lindberg & Samuel Panelius in 1953-54 (63 spp.). The male genitalia of a great number of the species are figured. Numerous of the Cape Verde species of the above groups of Lepidoptera are distributed over the continent of Africa and this indicates that the Cape Verde Islands should be referred to the Ethiopian region and not to the Palearctic. A number of the species are well known migrants with very wide distribution in subtropic areas. [W. H.]

Obraztsov, N. S., "Characters separating *Archips rileyanus* and *cerasivoranus* as two species (Lopidoptera, Tortricidæ)." *Ent. News*, vol.70: pp.263-267. 1959. Differences in adults, genitalia, & larvæ are pointed out. [P. B.]

Obraztsov, Nicholas S., "Notes on North American *Aphelia* species (Lepidoptera, Tortricidæ)." *Amer. Mus. Novit.*, no.1964: 9 pp., 15 figs. 1959. Transfers *Tortrix allenana* to *Aphelia;* describes as new *A. a. rindgeorum* (Valley View Lodge, 10 mi. S. of Steamboat Springs, Routt Co., Colo., 7600 ft.), *A. koebeli* (Easton, Washington), *A. septentrionalis* (McKinley Park, Alaska). [P. B.]

Obraztsov, Nicholas S., "On the systematic position of *Tortrix nigrivelata* (Lepidoptera, Tortricidae)." *Amer. Mus. Novit.*, no.1959: 6 pp., 5 figs. 1959. Erects *ECNOMIOMORPHA* for this Panamanian sp. [P. B.]

Obraztsov, N. S., "Beitrag zur Klassification der mitteleuropäischen Olethreutinæ (Lepidoptera: Tortricidæ)" [in German; English & Russian summaries]. *Beitr. Ent.*, vol.10: pp.459-485, 8 figs. 1960. Describes as new *BLASTESTHIA* (type *Phalæna Tinea turionella*); *FRŒLICHIA* (type *Tortrix textana*); *PRISTEROGNATHA* (type *Sericoris penthinana*); *PSEUDOHERMENIAS* (type *Phalæna clausthaliana*); *CAPRICORNIA* (type *Carpocapsa boisduvaliana*); *PARACELYPHA* (type *Phalæna rivulana*); *CELYPHOIDES* (type *Tortrix flavipalpana*). Proposes *herrichiana* n.n. for [*Barbara*] *margarotana* H.-S., uninominal & therefore not available; resurrects *margarotana* Heinemann for *Gravitarmata retiferana.* Gives a generic key to the *Argyroploce - Olethreutes* complex, & discusses species groups within these two genera. [P. B.]

Obraztsov, Nicholas S., "On the systematic position of two genera erroneously placed in the family Tortricidæ (Lepidoptera)." *Journ. New York ent. Soc.*, vol.68: pp.21-26, 2 pls. 1960. Transfers *Syncamaris to* Copromorphidæ & *Tapinodoxa* to Phaloniidæ; descriptive notes on type spp., *S. argophthalma* & *T. autonephes,* with figures of former. [P. B.]

Obraztsov, N. S., & J. A. Powell, "Data on *DECODES,* a new North American cnephasiid genus, with descriptions of new species (Tortricidæ)." *Journ.*

Lepid. Soc., vol.14: pp.112-126, 3 pls. 1961. Type *fragariana* Busck. Powell describes as new *D. montanus* (Mt. Lowe, Los Angeles Co., Calif.), *D. johnstoni* (Mt. St. Helena, Napa Co., Calif.), *D. aneuretus* (Carmel, Monterey Co., Calif.), *D. bicolor* (Mt. St. Helena).

Oku, Toshio, "Description of a new species of *Acleris* Huebner with notes on synonymy. (Notes on Tortricidæ of Japan, I) (Lepidoptera)." *Insecta matsumurana*, vol.21: pp.74-76, 1 fig. 1957. Describes as new *A. issikii* (Sapporo; reared from *Populus* spp.). Sinks *Cacœcia teshionis* to *Archips adumbratana*, & *C. punicæ* to *A. fuscocupreana*. [P. B.]

Olivier, R., "A propos de *Zygæna ephialtes* L. sub [sp]. *parisica* Reiss" [in French]. *Bull. Soc. ent. Mulhouse*, 1960: pp.78-80. Note on *Z. ephialtes* in Normandy; *parisica* is a synonym of *rubens* Verity. [P. V.]

Orfila, Ricardo N., "Notas sobre Lepidoptera Saturnioidea. I. *NAMUNCURAIA mansosotoi* gen.n., sp.n. (Hemileucid., Dirphiin.)" [in Spanish]. *Mision de Estud. Patol. regional Argentina*, vol.22, no.80: pp.45-52, 10 figs. 1951. Type locality Tandil, Buenos Aires Prov., Argentina; larvæ, on *Eryngium*, produce local dermatitis in humans. [P. B.]

Orfila, Ricardo N., "Notas sobre Lepidoptera Saturnioidea. II. Una especie nueva de *Hylesia* (Hemileucid.) dermatitogena de Venezuela" [in Spanish]. *Mision de Estud. Patol. regional argentina*, vol.23: pp.119-121, 1 fig. 1952. Describes as new *H. caripitox* (Caripito, Venezuela). [P. B.]

Orfila, Ricardo N., & Nelida H. Rossi, "Nuevos nombres genéricos en Lepidoptera" [in Spanish]. *Rev. Soc. ent. Argentina*, vol.19: pp.27-29. 1956. Proposes the new names: *GATESCLARKEIA* (Chrysaugidæ) to replace *Curicta* Walker, preoccupied (type *C. oppositalis*); *MICHENERIA* (Noctuidæ) to replace *Aræa* Hampson, preoccupied (type *A. attenuata*); *MOUREIA* (Noctuidæ) to replace *Meroleuca* Hampson, preoccupied (type *M. microglossa*). Points out that *Cogia* Butler (Hesperiidæ) is preoccupied & must be replaced by *Caicella* Hemming. [P. B.]

Orfila, Ricardo, & Sergio Schajovskoi, "Noctuidæ (Lep.) nuevos o poco conocidos del Parque Nacional Lanin, Neuquen" [in Spanish]. *Rev. Soc. ent. Argentina*, vol.20: pp.33-39, 1 pl. 1957. Describes as new *LANINIA* (Cuculliinæ, monobasic), *L. fletcheri* (San Martin de los Andes); *Epipsilia nelidæ* (Pucará). Sinks *E. ochricraspia* to *E. flavicosta*. [P. B.]

Orfila, Ricardo N., "Notas sobre Lithosiidæ (Lepid.). II. El genero *COSTALIMAIDA* nov." [in Spanish]. *Physis*, vol.21: pp.68-74, 1 pl. 1958. Describes new genus for *Cisthene triplaga* (type) & *C. itatiayæ;* redescribes spp. [P. B.]

Orfila, Ricardo N., & Sergio Schajovskoy, "Geometridæ (Lepidoptera) del Parque Nacional Lanin (Argentina). I. El genero *LACARIA* nov." [in Spanish; English summary]. *Acta zool. lilloana*, vol.17: pp.197-216, 1 pl., 10 figs. 1959. Describes as new tribe LACARINI, based on *LACARIA;* the type species *L. araucanaria* (Pucurá); *L. sperryi* (Lago Paimun), *L. picuncharia* (Pucará), *L. monrosi* (Pucará), *L. aczeli* (Pucará); all from Parque Nacional Lanin, Neuquen, Argentina, as is *Casbia schajovskyi* Sperry (emended spelling) which is also placed in *Lacaria*. Key to spp. [P. B.]

Orfila, Ricardo N., & Sergio Schajovskoy, "Geometridæ (Lep.) del Parque Nacional Lanin, Argentina. II. El genero *Euclidiodes* olim (Ennominæ)" [in Spanish]. *Rev. Soc. ent. Argentina*, vol.22: pp.7-33, 1 pl., 17 figs. 1960. Redescribes *Euclidiodes*, & type, *E. ophiusina;* assigns related spp. to other genera, as follows: *CATRIELIA*, type *agitata* (Bulter); *Proteopharmacis* Warren, type *P. valdiviata* (Felder & Rogenh.); *COIRONALIA*, type *cruciferaria* (Berg), including *C. denticulata* (Butler); *PUCARAIA*, type *P. lizeri* n.sp. (Pucara, Parque Nacional Lanin). Key to genera; all spp. described & figured. [P. B.]

Paclt, Jiří, "A protest against the atomizing of genera, with special reference to the Hepialidæ (Lepidoptera)." *Syst. Zool.*, vol.6: pp.51-52. 1957. Sinks *Gymelloxes, Pfitzneriana*, & *Aplatissa* to *Æpytus; Xhoaphryx* to *Hepialiscus*. Complains of

inadequate definitions & comparisons of new genera, & excessive reliance on ♂ genitalia. [P. B.]

dos Passos, Cyril F., & Alexander B. Klots, "Proposal for the amendment of Article 21 of the *Règles* (i.e. Draft Article 22) so as to make its operation entirely objective in cases when a person other than the nominal author of the book or paper concerned is responsible for a name and its indication, definition or description." *Bull. zool. Nomencl.*, vol.15: pp.695-702. 1958. Authorship of *Copæodes* and *Colias eurydice* involved. [P. B.]

dos Passos, Cyril F., "The satyrid butterflies of northwestern North America (Lepidoptera: Satyridæ)." *Proc. 10th internat. Congr. Ent.*, vol.1: pp.673-681. 1958. Catalogue of spp. (*Cœnonympha, Cercyonis, Œneis, Erebia*) of Alaska & northwestern Canada, west of the plains, including synonymy & type localities. Discusses biotic provinces in this area & the satyrid fauna of each. [P. B.]

dos Passos, Cyril F., "The authorship and dates of publication of the names of some Rhopalocera proposed in the *Reise der Œsterreichischen Fregatte* Novara *um die Erde in den Jahren 1857, 1858, 1859 unter den Befehlen des Commodore B. von Wüllerstorf-Urbair,* 1864-1867-[1875]." *Lepid. News,* vol.12: pp.193-194. 1959.

dos Passos, Cyril F., "The authorship of the names proposed in the *Natural history of the rarer lepidopterous insects of Georgia* (1797)." *Lepid. News,* vol.12: pp.191-192. 1959.

dos Passos, Cyril F., "The dates and authorships of the names proposed in volume 9 of *Encyclopédie Methodique* by Godart and Latreille, 1819-[1824]." *Lepid. News,* vol.12: pp.119-120. 1959.

dos Passos, Cyril F., "The dates and authorships to be ascribed to the generic and specific names proposed by Boisduval and Leconte and by Leconte alone in the *Lépidoptères de l'Amérique Septentrionale,* 1829-1833-[1834]." *Lepid. News,* vol.12: pp.121-122. 1959.

dos Passos, Cyril F., "The dates and authorships of some names proposed by Cramer and Stoll in *De uitlandsche kapellen voorkomende in de drie waereld-deelen Asia, Africa en America,* and by Stoll alone in *Aanhangsel van het werk, de uitlandsche kapellen, voorkomende in de drie waereld-deelen Asia, Africa en America, door den Heere Pieter Cramer* [1775]-1791." *Lepid. News,* vol.12: pp.195-198. 1959.

dos Passos, Cyril F., "Taxonomic notes on some nearctic Rhopalocera. 1. Hesperiodea." *Journ. Lepid. Soc.,* vol.14: pp.24-36. 1960.

Paulian, R., "Étude sur les lépidoptères malgaches. I. Deux nouveaux satyrides" [in French]. *Naturaliste malgache,* vol.2: pp.51-52, 2 figs. 1950. *Strabena io* (Mandritsara) & *S. cachani* (Moramanga), two new species of Madagascar Satyridæ. [P. V.]

Paulian, R., "Études sur les lépidoptères malgaches. II. Nouveaux satyrides" [in French]. *Mém. Inst. scient. Madagascar, ser. A,* vol.6: pp.387-394, 9 figs. 1951. Descriptions and figures, with details of the genitalia, of eight new satyrid species of Madagascar: *Strabena isoalensis* (W. Madagascar, Isalo), *S. andilabe* (N. Madagascar, Tsaratanana Mt.), *S. tsaratananæ* (same), *S. perrieri* (same), *S. mandraka* (central Madagascar, La Mandraka), *S. albiviltuloides* (E. Madagascar, Moramanga); *Henotesia aberrans* (N. Madagascar. Tsaratanana Mt.). [P. V.]

Paulian, R., "Danaidæ, Nymphalidæ, Acræidæ" [in French]. *Faune de Madagascar,* vol.2: 102 pp., 110 figs. 1956. A faunal list of these families of Rhopalocera of Madascar, with keys and descriptions of the species. [P. V.]

Paulian, R., & G. Bernardi, "Les *Eurema* de la region malgache (Lep. Pieridæ)" [in French]. *Naturaliste malgache,* vol.3: pp.139-154, 2 figs. 1951. Keys, descriptions and drawings of the genitalia of the five species of Madagascar *Eurema. E. floricola* and *E. hecabe,* sometimes considered conspecific, are two distinct species and are both found in Madagascar. [P. V.]

Pease, Roger W., jr., "A study of first instar larvæ of the Saturniidæ, with special reference to nearctic genera." *Journ. Lepid. Soc.,* vol.14: pp.89-111, 5 pls. 1961.

Pelham-Clinton, E. C., "*Coleophora sternipenella* (Zetterstedt) (Lep., Coleophoridæ), a new British species; with a key to the British *Coleophora* on *Chenopodium* and *Atriplex*." *Entomologist*, vol.92: pp.120-124, 6 figs. 1959. Distinguishes newly recorded species from *C. flavaginella* & *C. versurella*. Key to 8 spp. [P. B.]

Pennington, K. M., "A new species of *Thestor* Hübner (Lepidoptera–Lycænidæ) from the western Cape Province and notes on the life history of *Desmolycæna mazoensis* Trimen." *Journ. ent. Soc. southern Africa*, vol.19: pp.33-36, 4 figs. 1956. Describes as new *T. rileyi* (Lourensford, Somerset West, 1550 ft.). Pupæ of *D. mazoensis* found on young *Acacia*. [P. B.]

Pereira, Olga de Avila, "Contribuição ao conhecimento dos Ctenuchidæ (Lep.). VIII. Genero *Orcynia* Walker. 1854" [in Portuguese; English summary]. *Pap. avuls. Dep. Zool.*, São Paulo, vol.13: pp.161-177, 2 pls., 32 figs. 1958. Very detailed redescription of genus & sole species, *O. calcarata*. [P. B.]

Petersen, Günther, "Die Genitalien der paläarktischen Tineiden (Lepidoptera: Tineidæ)" [in German; English & Russian summaries]. *Beitr. Ent.*, vol.7: pp.55-176, 338-379, 557-595; vol.8: pp.111-118, 398-430; 9 pls., 267 figs. 1957-58. Actually a revision of the family, based on study of all available palearctic spp.; the ♂ and ♀ genitalia. which are described & figured, are the most important specific characters and, with larval food (when known) are the fundamental characters used in higher classification. Describes as new: *Nemapogon gravosaellus* (Orsova, Banet), *N. heydeni* (Austria), *N. signatellus* (Macedonia); CERATUNCUS (type *Myrmecozela danubiella*); *Reisserita zernyi* (Monchique, S. Portugal), *R. luteopterella* (Goundafa, Gr. Atlas, Morocco); *Fermocelina christophi* (S. Russia), *F. almaella* (Alma, Algeria), *F. oranella* (Teniet et Haad. Algeria); *CERATOPHAGA* (type *Tineola infuscatella*), *C. kuldjaensis* (Kuldja, central Asia); *NIDITINEA* (type *Tinea fuscipunctella*), *N. distinguenda* (Frankfurt a.M., Germany); *Tinea leonhardi* (Castelnuovo, Dalmatia); *PARATINEA* (type *Tinea merdella*); *Monopis christophi* (Sarepta, S. Russia); *MONTETINEA* (type *Tineola tenuicornella*), *M. montana* (Macugnaga, Walliser Alpen); *LICHENIVORA* (type *Tinea nigripunctella*); *OBESOCERAS* (type *Tinea granulatella*); *Infurcitinea amseli* (Georgskloster, Wadi el Kelt, Palestine); *LICHENOTINEA* (type *Tinea pustulatella*), *L. maculata* (Burg Kate, Rhineland, Germany); *Catabola zernyi* (=*Tinea hirudinea* Zerny, *nec* Meyrick) (Tachdirt, 2200-2700 m., Gr. Atlas, Morocco), *C. agenjoi* (=*Crassicornella crassicornella* Agenjo, *nec* Zeller) (Granada, Spain), *C. bifurcatella* (Tunis); *Myrmecozela lambessella cuencella* (Cuenca, Spain); *MOROPHAGOIDES* (type *Scardia ussuriensis*); *Rhodobates mauretanicus* (Egypt); *PARARHODOBATES* (type *Chimabacche? syriaca*). Many new synonyms. No subfamilies are used, but seven groups of genera are recognized, centered around *Nemapogon, Tinea, Infurcitinea, Catabola, Scardia, Euplocamus,* & *Rhodobates*. Some genera & spp. of uncertain position are discussed. An important and impressive paper. [P. B.]

Petersen, Günther, "Neue paläarktische Tineiden aus der Gruppe der lichenophagen Gattungen (Lep. Tineidæ)" [in German]. *Deutsche ent. Zeitschr.*, N. F., vol.5: pp.367-375, 12 figs. 1958. Describes as new *Obesoceras romanum* (La Cava, Monti Albani); *Infurcitinea raddei* (S. Caucasus), *I. olympica* (Olympus Kataphygion, Greece), *I. lambessella* (Lambessa). Descriptive notes, mainly on genitalia, for *Meessia alberti, Obesoceras holtzi,* 4 spp. of *Infurcitinea*, & *Lichenotinea maculata*. [P. B.]

Petersen, Günther, "Ergebnisse der Untersuchung indeterminierter paläarktischer Tineiden aus dem Zoologischen Museum Berlin und der Sammlung H. G. Amsel/Karlsruhe (Lep.)" [in German]. *Deutsche ent. Zeitschr.*, N. F., vol.6: pp.152-159. 3 figs. 1959. Describes as new *Cephimallota libanotica* (Lebanon). Gives first description of ♀ of *Ateliotum syriacum*. Sinks *Nemapogon oueddarellus* to *N. palmellus*, & *Tinea takhouki* to *Ceratuncus affinitellus*. Records of various spp. of these genera & *Fermocelina, Tinea, Monopis,* etc., with some descriptive & biological notes. [P. B.]

Petersen, Günther, "Revision der Gattung *Obesoceras* Pet. 1957 (Lepidoptera, Tineidæ)" [in German]. *Acta Soc. ent. Čechosloveniæ,* vol.56: pp.197-199, 1 fig. 1959. *O. danubiellum* from Krems a.D. (Austria) described as new. Figure of male genitalia. [J. M.]

Petersen, Günther, "Tineiden aus Afghanistan mit einer Revision der paläarktischen Scardiinen (Lepidoptera: Tineidæ)" [in German; English & Russian summaries]. *Beitr. Ent.,* vol.9: pp.558-579, 1 pl., 27 figs. 1959. Describes as new: *Pachyarthra asiatica* (Gulbahar-Sarobi Road, E. Afghanistan, 600 m., *Artemisia* steppe); *Catabola obscura* (Sarobi, E. Afghanistan, 1100 m.), *C. sarobiella* (Sarobi), *C. amseli* (Gulbahar, 1700 m., etc.), *C. afghana* (Sarobi); *Episcardia luteola* (Sarobi), *E. pygmæana* (Sarobi); *Nemapogon flavifrons* (Polichomri, N. Afghanistan, 700 m.); *Neurothaumasia fasciata* (Khinch-e-Andarab, W. Pamirs, N. Afghanistan, 3500-4000 m.); *Paratinea orientalis* (Gulbahar-Sarobi Road), *P. sarobiella* (Sarobi); *Morophaga nigricapitella* (Arghandab Road, 30 km. N. of Kandahar, SW Afghanistan, 1000 m.). Gives keys to known spp. of *Pachyarthra, Episcardia, Neurothaumasia,* & *Haplotinea.* Records some other tineids, with systematic notes. Reduces Scardiinæ to 3 genera: *Scardia* (=*Montescardia, n. syn.*), *Morophaga* (=*Atabyria* & *Microscardia, nn. synn.*), and *Morophagoides.* Gives key to genera & palearctic spp. [P. B.]

Petersen, Günther, "Die *Monopis*-Arten der *rusticella*-Gruppe (Lepidoptera: Tineidæ)" [in German; English & Russian summaries]. *Beitr. Ent.,* vol.10: pp.409-418, 2 pls., 4 figs. 1960. Distinguishes *M. rusticella, M. weaverella,* & *M. spilotella* by genitalia; sinks *Tinea biflavomaculella* to *M. spilotella.* [P. B.]

Plantrou, J., "Note sur la répartition en France de *Clossiana titania* Esper (=*amathusia* Esper)" [in French]. *Alexanor,* vol.1: pp.198-200, pl.IV, figs.1-6. 1960. Note on the distribution in France of this argynnid; describes as new *C. t. lemagneni* (Lozere, Saint-Denis-en-Margeride). [P. V.]

Popescu-Gorj, A., E. Nicolescu, & A. Alexinschi, "Lepidoptera-Ægeriidæ". *Fauna Republicii Populare Romine,* vol.XI, fasc.1: 195 pp., 5 pls., 59 figs. Bucharest, 1958. The authors give a detailed study about the Ægeriidæ of Rumania. In this country the distribution of 40 spp. is recorded; 2 spp. probably occur. but have not been collected. Descriptions and life-histories are also included. The introductory part (pp.1-48) is a short review of the morphology, zoogeography, & bibliography of the family in Rumania. In the succeeding systematic part all known spp. are discussed in detail. Index and plates are at the end of the book, which is the first volume about Lepidoptera in the book-collection "Fauna of Rumania". It is a very important contribution to the knowledge of the lepidopterous fauna of this country. [J. M.]

Popescu-Gorj, Aurelian, "*Erebia carpathicola* A. Popescu-Gorj et A. Alexinschi, une nouvelle espèce du genre *Erebia* (Lep. Satyridæ) des Carpathes roumains" [in French]. *Entomologist,* vol.92: pp.23-26, 1 pl. 1959. Type locality Mt. Haghimasul Mare, E. Carpathians, 1600-1700 m. [P. B.]

Povolný, Dalibor, & Josef Moucha, "Kritischer Nachtrag zur Kenntnis der Taxonomie und Zoogeographie der Gattung *Psodos* Tr. (Geometridæ)" [in German]. *Acta ent. Mus. nationalis Pragæ,* vol.32: pp.181-190, 18 figs. 1958. The paratypes of *P. wehrlii* Vorbr. and the genitalia are figured. *P. diószeghyi* Schmidt is not a good sp. but a ssp. of *P. coracina* Esp. [J. M.]

Povolný, Dalibor, & Josef Moucha, "II. Nachtrag zur Kenntnis der Taxonomie und Zoogeographie der Gattung *Psodos* Tr." [in German]. *Acta ent. Mus. nationalis Pragæ,* vol.33: pp.333-336, 1 pl. 1959. The Asiatic sp. *P. daisetsuzana* Mats. is discussed & sunk to *P. coracina* Esp.; genitalia figured. [J. M.]

Povolný, Dalibor, & Josef Moucha, "Kritische Bemerkungen zu einigen Geometridengattungen II. (*Narraga, Isturgia, Epelis*)" [in German]. *Acta ent. Mus. nationalis Pragæ,* vol.33: pp.453-460. 2 pls. 1959. Genus *Fernaldella* Hulst is only a subgenus of *Narraga* Wkr. Genus *Epelis* Hulst is identical with *Semiothisa.* [J. M.]

Povolný, Dalibor, "The high-mountain Geometridæ of the genus *Psodos* Treitschke in relation to the species problem." *Proc. XV internat. Congr. Zool.*, pp.160-165, 11 figs. 1959. Discusses phylogeny of genus & its relatives (Psodinæ, Gnophinæ), with notes on geographic origin & modifications of ♂ genitalia. [P. B.]

Powell, Jerry A., "A new species of the genus *Chionodes* in California (Lepidoptera, Gelechiidæ)." *Ent. News*, vol.70: pp.127-130, 3 figs. 1959. Describes as new *C. sabinianæ* (Russelman Park, Mt. Diablo, Contra Costa Co.; reared from staminate cones of *Pinus sabiniana.* [P. B.]

Powell, Jerry A., "Studies on the genus *Ethmia* Huebner in western North America (Lepidoptera: Gelechioidea)." *Wasmann Journ. Biol.*, vol.17: pp.133-151, 1 pl. 1959. Describes as new *E. epileuca* (Surprise Canyon, Panamint Mts., Inyo Co., Calif.), *E. chemsaki* (34 mi. S. of Atlixco, Puebla, Mex.), *E. zebrata* (same locality). Describes ♂ of *E. phœnicura.* Locality records are given for 16 other spp., with some systematics & biological notes. [P. B.]

Pröse, Herbert, "Ein Beitrag zur Kenntnis der bayerischen Tortriciden" [in German]. *Nachrichtenbl. bayer. Ent.*, vol.7: pp.26-30, 40, 2 figs. 1958. Sinks *Eriopsela roseni* & *E. bavarica* to *E. quadrana.* Distinguishes *Acleris tripunctana* from *A. ferrugana.* Notes on identity & distribution of some other Bavarian spp. [P. B.]

Prout, L. B., "New species of Indo-Australian Geometridæ." *Bull. British Mus., Ent.*, vol.6: pp.365-463, 6 pls. 1958. Descriptions of spp. figured on plates 29-34, 36-41m & 50 of Seitz, vol.12 (the accompanying text was never published), and additional descriptions of and information on other spp. named in the same volume; prepared by D. S. Fletcher from Prout's notes, with descriptions of additional spp. which would have been published in this volume had it been finished. New: *Eustroma hampsoni* (=*Cidaria "interplagiata* Guenée" of Hampson); *Sterrhochæta rectilineata indirecta* (Paloe, Sidaonta, 4,500 ft.); *EXODEZIA* (type *Eulype albifusa*); *Physetobasis dentifascia kachinica* (Htawgaw, 6,000 ft.), *P. d. rectipendens* (lower Burma), *P. d. kiunkiangana* (Liunkiang); *Eupithecia raniata* (Darjeeling), *E. circumacta* (Darjeeling), *E. albibaltea* (Darjeeling), *E. pyricoetes* (Sikkim), *E. peguensis* (E. Pegu, 4,000-5,000 ft.), *E. albigutta* (Simla, 7,000 ft.), *E. fulcrata* (Htawgaw, 6,000 ft.), *E. mundiscripta commundata* (Mt. Kinabalu), *E. m. larutensis* (Perak, Larut Hills, 3,700 ft.), *E. excita* (Tjamba, near Maros, 1,500 ft.), *E. wardi* (Tsangpo Valley, Tya La, 14,000 ft., SE Tibet), *E. leucoprora* (Mt. Goliath, 5,000-7,000 ft., about 139° E. Long., central Dutch New Guinea), *E. lissopis* (same locality); *Micromia expectans* (Angabunga R., affluent of St. Joseph R., 6,000 ft. upwards, British New Guinea), *M.* (*Prosthetopteryx*) *hypocalypsis* (Mt. Tafa, 8,500 ft., Papua), *M.* (*P.*) *euthynsis* (Mt. Goliath), *M.* (*P.*) *e. evelina* (Mt. Tafa), *M.* (*P.*) *leucocarpa* (Mt. Tafa), *M.* (*P.*) *acroscotia* (Mt. Tafa), *M.* (*P.*) *novenaria* (Mt. Goliath), *M.* (*P.*) *recessilinea* (Mambare R., 5,000 ft., Br. New Guinea), *M.* (*P.*) *dympna* (Mt. Goliath), *M.* (*P.*) *conquadrata* (Mt. Goliath), *M.* (*P.*) *dystacta* (Mt. Tafa), *M.* (*P.*) *ectocosma* (Mt. Goliath), *M.* (*P.*) *ni* (Mt. Goliath), *M.* (*P.*) *thaumasia* (Mt. Goliath), *M.* (*P.*) *monochasma* (Mt. Goliath), *M.* (*P.*)*dilopha* (Mt. Goliath); *Chloroclystis consueta bowringi* (SE Ichang, Ya-chiao-ling, China), *C. leucopygata cata* (Pangean near Maros, 2,000 ft., SW Celebes), *C. horistes* (Phyalloloong, 12,600 ft., Nepal frontier). *C. atroviridis perspecta* (Patipola, Ceylon), *C. boarmica* (G. Lampobattang, Parang-bobo-Goa, 5,000 ft., SW Celebes), *C. naga* (Naga Hills, 5,000-7,000 ft., India), *C. sinuosa reddita* (Haputale, Ceylon), *C. griseorufa tranquillata* (Kuala Lumpur, Malaya), *C. actephilæ* (Kanara, Castle Rock, S. India), *C. eichhorni* (New Ireland), *C. distigma* (Snow Mts., Upper Setkwa R., 2,000-3,000 ft., Dutch New Guinea), *C. rhodopis* (Hydrographer Mts., 2,500 ft., Br. New Guinea), *C. infusata errabunda* (Takow, Formosa), *C. i. albitornalis* (Karwar, S. India), *C. i. exortiva* (Mt. Rossel, 2,100 ft., Rossel Is.), *C. taraxichroma* (Batoeriti, 3,500 ft., E. Bali), *C. breyniæ* (Pusa, India, *ex* larva on *Breynia rhamnoides*), *C. woodjonesi* (Cocos-Keeling Is.), *C. lepta æneta*

(Tonga), *C. invisibilis invita* (Koelawi, Paloe, 3,700 ft., W. Celebes), *C. magnimaculata irabunda* (Flagstaff, New Zealand), *C. lanaris æquabilis* (Mt. Rice, 2,000 ft., Sudest Is.), *C. xenisma* (G. Tompoe, Paloe, 2,700 ft., W. Celebes), *C. pugnax* (Hydrogropher Mts., 2,500 ft., Br. New Guinea), *C. apotoma* (G. Lampobattang, Parang-bobo-Goa, 5,000 ft., SW Celebes), *C. omocydia* (Hydrographer Mts., 2,500 ft., Br. New Guinea), *C. autopepla* (Mt. Goliath, 5,000-7,000 ft., Dutch New Guinea), *C. alpinista eupora* (Mondoktoempang, 2,500 ft., W. Bali), *C. acervicosta* (Sambawa), *C. catabares* (Paloe, G. Tompoe, 2,700 ft., W. Celebes), *C. curviscapulis* (Darjeeling, Gopaldhara, 3,440-5,800 ft., India), *C. melampepla* (Paloe, G. Rangkoenau, 1,800 ft., W. Celebes), *C. orphnobathra* (Kedah Peak, 3,000 ft., Malaya), *C. œdalea* (Mt. Kinabalu, N. Borneo), *C. phœnicophaes* (Paloe, G. Tompoe, 2,700 ft., W. Celebes), *C. cuneativenis* (same locality), *C. pygmæica* (Ceylon), *C. atypha* (Paloe, G. Rangkoenau, 1,800 ft., W. Celebes), *C. dilatata hydrographica* (Br. New Guinea), *C. luciana* (Dharmsala, India), *C. nudifunda* (Pahang, Cameron Highlands, 5,500 ft., Malaya), *C. semiscripta brychoma* (Paloe, G. Tompoe, 2,700 ft., W. Celebes), *C. palmaria phantastes* (Gedeh, Java), *C. permixta* (Tengger, Kletak, 6,000 ft., Java), *C. filicata mochleutes* (Tjamba, near Maros, 1,500 ft., SW Celebes), *C. dissographa* (G. Lampobattang, Parang-bobo-Goa, 5,000 ft., SW Celebes), *C. craspedozona* (Batoeriti, 3,500 ft., E. Bali), *C. c. venata* (Haight's Place, 7,000 ft., Pauai, Benguet, Luzon), *C. c. heanis* (Manusela, 6,000 ft., central Ceram), *C. palpata diechusa* (Khasi Hills, India), *C. p. javana* (Mt. Moenggal, 9,000 ft., E. Java), *C. regularis viridimargo* (Perak, 2,000-3,500 ft., Malaya), *C. diabœta* (Manusela, 6,000 ft., central Ceram), *C. viridata phæina* (Paloe, G. Tompoe, 2,700 ft., W. Celebes), *C. diaschista* (Mt. Goliath, 5,000-7,000 ft., Dutch New Guinea), *C. subpalpata* (Bukit Kutu, 3,500 ft., Selangor, Malaya), *C. s. fractiscripta* (Haight's Place, Pauai, Benguet, Luzon, 7,000 ft.) (all above have been figured in Seitz); *Ziridava xylinaria khasiensis* (Khasia Hills), *Z. x. kanshireiensis* (Kanshirei, Formosa), *Z. x. baliensis* (Batoeriti, 3,500 ft., Bali), *Z. x. florensis* (S. Flores), *Z. rufinigra cedreleti* (Cedar Bay, S. of Cooktown, Queensland), *Z. asterota* (Mt. Kina Balu, N. Borneo); *Calluga grammophora* (Mt. Goliath, 5,000-7,000 ft., Dutch New Guinea); *Gymnoscelis polyclealis albicetrata* (Paloe, G. Tompoe, 2,700 ft., W. Celebes), *G. p. hyperocha* (Kuranda, Queensland), *G. expedita* (Bukit Kutu, Selangor, Malaya, 3,500 ft.), *G. ammocyma* (Aden), *G. pœcilimon* (New Ireland), *G. festiva buruensis* (Leksula-Fakal, 2,800-3,700 ft., Buru), *G. f. jubilata* (G. Lampobattang, Parang-bobo Goa, 5,000 ft., SW Celebes), *G. holoprasia* (Prapetagoeng, 1,500 ft., W. Bali), *G. protracta* (Perak, Larut Hills, 3,700 ft., Malaya), *G. pyrissous* (Tambora), *G. imparatalis opta* (Vulcan Is.), *G. anaxia* (Tomia, Toekan Bessi Is.), *G. tristrigosa nasuta* (Palni Hills, S. India), *G. t. tongaica* (Haapai Is., Tonga Is.), *G. argyropasta* (St. Matthias Is.), *G. lavella* (Vella Lavella, Solomon Is.), *G. distatica* (Khasia Hills, India), *G. derogata griseifusa* (Paloe, Gunong Tompoe, 2,700 ft., W. Celebes), *G. d. abrogata* (Hydrographer Mts., 2,500 ft., Br. New Guinea), *G. phœnicopus* (Manusela. 6,000 ft., central Ceram), *G. erymna nephelota* (Lautoka, Fiji), *G. mesophœna hagia* (St. Matthias Is.), *G. m. taprobanica* (Puttalam, Ceylon), *G. m. celebensis* (Paloe, G. Rangkoenau, 900 ft., W. Celebes), *G. oblenita* (Bukit Kutu, 3,500 ft., Selangor, Malaya), *G. conjurata* (Punduloya, Ceylon), *G. latipennis* (Perak, Gunong Ijan, Malaya), *G. l. nepotalis* (Tengger, Singolangoe, 5,000 ft., E. Java); *Onagrodes victoria* (Victoria, S. Tenasserim, Burma), *O. barbarula* (New Ireland), *O. oosyndica* (Pahang, Cameron Highlands, 4,800 ft., Malaya), *O. eucineta* (Bukit Kutu, Selangor, 3,500 ft., Malaya); *Pseudomimetis vailima* (Upolu, Vailima, Solomon Is.); *Hybridoneura metachlora lativitra* (Bukit Kutu, Selangor, 3,500 ft., Malaya), *H. truncata* (Hydrographer Mts., 2,500 ft., Br. New Guinea); *Antimimistis attenuata melamphaes* (Paloe, G. Tompoe, 2,700 ft., W. Celebes), *A. cuprina* (Haldamulla, Ceylon); *Brabira operosa* (7,000 ft., Sikkim); *Microloba bella*

taracta (Sikkim); *Heterophleps paraspasta* (Mt. Victoria, Pakokku, Chin Hills, 2,600 m., Burma), *H. heinrichi* (Pakokku, Chin Hills, 2,200 m., Burma); *ELLIPOSTOMA* n.n. for *Myostoma* Warren, preoccupied; *Cryptoloba mesta* (Shillong, India), *C. peperitis* (Sikkim), *C. metorchatica* (Tien-Tsuen, W. China); *CHRIOLOBA* (type *Lygranoa cinerea* Butler), *C. andrewesi* (Pykara, 6,500 ft., Nilgiri Hills), *C. ochraceistriga* (Khasia Hills, India), *C. o. sectilinea* (Moulin, W. China); *Carige extremaria coniochyta* (Pakokku, 2,200 m., Mt. Victoria, Burma); *Goniopteroloba biconcava* (Mt. Kina Balu, N. Borneo), *G. pallida pangeanensis* (Pangean, near Maros, 2,000 ft., SW Celebes); *Leptostegna asiatica antelia* (Wa-Shan, 6,000 ft., China); *Acasis viretata himalayica* (Khasia Hills, India); *Nothocasis octubris* (Szechuan. Liang-fen-kiang, 2,500 ft. to Shih-shah-shu, 7,400 ft.); *Trichopteryx polystictaria tsangpoensis* (Tsangpo Valley, Doshong La, 10,500 ft., SE Tibet), *T. knyvetti* (Sikkim); *Trichopterygia rubripuncta miantosticta* (Siao-Lou, W. China), *T. dejeani* (Ta-Tsien-Lou, W. China), *T. rufinotata illumina* (Yatong, Tibet), *T. pilcheri* (Darjeeling, India), *T. rivularis acidnias* (Tsekou, W. China), *T. adiopa* (Darjeeling, India), *T. hagna* (Mishmi Hills, Minutang, 3,900 ft., Burma), *T. micradelpha* (Sikkim), *T. teligera* (Narkundah, Kashmir), *T. pulcherrima exsanguis* (Haight's Place, Pauai, Benguet, Luzon); *Phthonoloba decussata moltrechti* (Arizan, Kagé Distr., 8,000 ft., Formosa); *Steirophora permista* (Haight's Place, 7,000 ft., Pauai, Benguet, Luzon); *Episteira delicate isoepes* (Manusela, 6,000 ft., central Ceram); ?*E. carchara* (Riu-kio Is.); *Megaloba eucola* (Goodenough Is., 2,500-4,000 ft.), *M. loxobasma* (Mt. Goliath, 5,000-7,000 ft., Dutch New Guinea), *M. admeta* (Manusela, 6,000 ft., central Ceram), *M. a. papuana* (Mt. Tafa, 8,000 ft., Papua); *Dystypoptila hebes* (Paloe, G. Tompoe, 2,700 ft., W. Celebes); *Sauris eupitheciata isocraspeda* (Vulcan Is.), *S. arfakensis catopercna* (Mrapat, 5,000 ft., central Buru), *S. a. seclusa* (Kedah Peak, 3,200 ft., Malaya), *S. patefacta* (Fraser's Hill, 4,000 ft., Pahang, Malaya), *S. olearia* (G. Lampobattang, Parang-bobo Goa, 5,000 ft., SW Celebes), *S. erecta sententiosa* (Manusela, 6,000 ft., central Ceram), *S. ptychosyrma* (Paloe, G. Tompoe, 2,700 ft., W. Celebes), *S. basilia* (Gunong Lampobattang, Parang-bobo Goa, 5,000 ft., SW Celebes), *S. muscosa pleonectes* (Paloe, G. Rangkoenau, 1,800 ft., W. Celebes), *S. inscissa* (Khasia Hills, India), *S. othnia* (Batchian), *S. usta asema* (Nongkodjadjar, 4,000 ft., E. Java), *S. oetawana* (Snow Mts., near Oetakwe R., up to 3,500 ft., Dutch New Guinea). Some "abs." are also named. Most new entities described in the second part are figured. Specimens on the Seitz plates are identified. [P. B.]

Razowski, J., "*Acleris heringi* n. sp. (Tortricidæ)—a new species from central Asia" [in English; Polish summary]. *Bull. ent. Pologne,* vol.27: pp.139-140, 1 fig. 1958. One specimen (male) from Samarkand; the genitalia are figured. [J. M.]

Razowski, Józef, "New and little known Palearctic species of the Cnephasiini (Tortricidæ)" [in English; Polish & Russian summaries]. *Acta zool. cracov.,* vol.2: pp.560-606. 1958. As new are described: *Cnephasia* (*Anoplocnephasia*) *margelanensis* (Margelan, Ferghana valley, USSR), *C.* (*A.*) *stachi* (Samarkand, USSR); *Eana* (*Eana*) *hungariæ* (?Hungary), *E.* (*E.*) *samarkandæ* (Samarkand, USSR), *E.* (*E.*) *pallifrons* (Ulan-Bator, Mongolia); *Cnephasia* (*Cnephasia*) *nowickii* (Uliassetai, Mongolia), *C.* (*C.*) *heringi* (Amasia), *C.* (*C.*) *constantinana* (Constantine), *C.* (*C.*) *alfacarana* (Sierra de Alfacar, Spain), *C.* (*C.*) *microstrigana* (S. Ildefonso, Spain), *S.* (*C.*) *parnassicola* (Parnass, Greece), *C.* (*C.*) *cinereipalpana* (Wladiwostok, USSR); also some "forms". Genitalia & imagos of all new spp. are figured. [J. M.]

Razowski, J., "Remarks on the species of the subgenus *Brachycnephasia* Réal and a new species of the subgenus *Cnephasia* s.s. (Tortricidæ)" [in English; Polish summary]. *Bull. ent. Pologne,* vol.27: pp.75-84, 8 pls. 1958. Describes as new *C.* (*B.*) *tripolitana* (Jefren, Tripolitania), *C.* (*B.*) *klimeschi* (Stari Dojran, Macedonia); and *C.* (*C.*) *fiorii* (Jefren, Tripolitania). All types & genitalia are figured. [J. M.]

F. BIOLOGY AND IMMATURE STAGES

Khanna, K. L., L. N. Nigam, & V. D. Puri, "*Chilo tumidicostalis* Hampson—a serious stem borer pest of sugarcane in Bihar." *Proc. Indian Acad. Sci.*, vol.36: pp. 75-94, 7 pls. 1957. Describes biology, distribution, & economic importance; figures all stages. [P. B.]

Kibe, Mitsunori, "Breeding of *Cœnonympha œdippus* and *Pararge achine* (Satyridæ) in Korea" [in Japanese]. *Insect Ecology*, vol.2: pp.65-69, 7 figs. 1948. Foodplants: sedges and grasses. [T. I.]

Kibe, Mitsunori, "Life-history of *Papilio helenus nicconicolens* Butler, with morphological notes on its earlier stages" [in Japanese]. *Insect Ecology*, vol.4, no.10: pp.45-54, 5 figs., 1 pl. 1952. Foodplant: *Ponciris trifolia.* [T. I.]

Kirst, G., & F. Stauder, "Auftreten und Bekämpfung des *Ennomos quercinaria* Hfn. in den Forstämtern Fischback (Saar) und Saarbrücken (1952-54)" [in German]. *Forstwiss. Zentralbl.*, vol.73: pp.271-275, 5 figs. 1954. Biology & control.

Kiyosawa, Haruchika, "On the life history of *Anthocaris cardamines isskii* Matsumura (Pieridæ) collected in Mt. Togakushi" [in Japanese]. *New Entomologist*, vol.1, no.2: pp.19-21, 1 fig. 1951. Foodplant:*Arabis lyrata.* [T. I.]

Klimesch, Josef, "Zur Chætotaxie der Raupe von *Bucculatrix fatigella* Heyd. (Lep. Bucculatrigidæ)" [in German]. *Zeitschr. wiener ent. Ges.*, vol.35: pp.143-145, 4 figs. 1950. Describes & figures larval setal pattern. [P. B.]

Klomp, H., "Die morphologischen Merkmalen und die Bionomie der Kiefernspanner-Tachine *Carcelia obesa* Zett. A=*rutila* B. B.)" [in German; English summary]. *Zeitschr. angew. Ent.*, vol.38: pp.228-294, 5 figs. 1956. Describes all stages & biology of this parasite of *Bupalus piniarius.* [P. B.]

Klomp, H., "The number of generations, the host-change and hibernation of *Trichogramma embryophagum* Htg. in pine woods in the Netherlands" [in Dutch; English summary]. *Ent. Berichten*, vol.16: pp.117-120, 2 figs. 1956. Biology of parasites of various pine-feeding Lepidoptera. [P. B.]

Klots, Alexander B., "The larva of *Hyperæschra georgica* (Notodontidæ)." *Lepid. News*, vol.10: pp.203-204. 1957.

Knight, Fred B., "Insect damage to Loblolly Pine cones." *Virginia Forests*, vol.7: pp.14-15, 2 figs., 1 map. 1952. *Dioryctria amatella* & *Laspeyresia toreuta* responsible. [P. B.]

Knight, John E., "Rearing *Antitype xanthomista* (Hübn.) (Black-Banded Moth)." *Ent. Gaz.*, vol.6: pp.164-165. 1955. Notes on larvæ; stock lost because of polyhedrosis. [P. B.]

Knowlton, George F., "Some insects of Utah celery fields." *Proc. Utah Acad. Sci.*, vol.25: pp.163-165. 1948. Abstract.

Kobayashi, Hiroshi, "Biology of lichen-feeding moths (1)" [in Japanese]. *Trans. lep. Soc. Japan*, vol.3: pp.9-10, 4 figs. 1953. *Parasiecia altaica* (Arctiidæ). [T. I.]

Kobayashi, Hiroshi, "On the morphological and biological study of *Chionæma hamata* Walker in Japan (Lepidoptera, Arctiidæ)" [in Japanese; English summary]. *Butt. & Moths* (*Trans. lep. Soc. Japan*), vol.4: pp.21-24, 7 figs. 1954. Describes early stages of this lichen-feeder; records parasite; gives distribution. [P. B.]

Kobayashi, Shiro, "Studies on the distribution structure of the Common Cabbage Butterfly *Pieris rapæ* in cabbage farm." *Sci. Rep. Tohoku Univ., 4th Ser.* (Biol.), vol.23: pp.1-6, 2 figs. 1957. Distribution of eggs contagious until late summer, then random; larval distribution tends to become random with more age. [P. B.]

Koch, Manfred, "Zur Biologie des Kiefernprozessionsspinners, *Thaumatopœa pinivora* Tr." [in German]. *Beitr. Ent.*, vol.3:pp.423-427. 1953. Sp. has a 2-year cycle and larvæ & adults are found in alternate years. Notes on emergence, adult habits, pupation. [P. B.]

Köchli, W., "Eine Beobachtung bei den Raupen von *P. cynthia*" [in German]. *Ent. Nachrichtenbl.*, Burgdorf, vol.2: p.41. 1948. Larva feeding on another, freshly dead, larva. [P. B.]

Koishikawa and Takeyaya Senior High Schools, "Research on the damages caused by *Hyphantria cunea* (Arctiidæ) in Tokyo" [in Japanese]. *Shin Konchu,* vol.4, no.11: pp.6-10, 2 figs., 3 maps, 3 tables. 1951.

Komárek, Oldřich, "Zur Bionomie und Ekologie *Calligenia* (*Miltochrista*) *miniata* (Forst.)" [in Czech; Russian & German summaries]. *Acta Soc. ent. Čechosloveniæ,* vol.52: pp.195-200, 3 figs. 1956. Interesting paper about life history of this species, namely about feeding of larvæ. [J. M.]

Korbel, Z., M. Luxova, & A. Lux, "Die Pappelmotte (*Phyllocnistis sufusella*) als Schädling der Pappelbaumschulen" [in Slovak; Russian & German summaries]. *Biol. Sborník,* vol.7: pp.127-142, 11 figs. 1952. Biology & control of this sp. are described. *P. sufusella* is a pest of poplar in S. Slovakia. [J. M.]

Kovács, L., "Die Wirkung der gelegentlichen Gesellschaften auf die Dispersion der Schmetterlingsimagos" [in German; Magyar & Russian summaries]. *Ann. Hist.-nat. Mus. nation. hung.,* ser.2, vol.3: pp.191-201. 1953. Records numerous nocturnal Lepidoptera feeding at sunflowers; shows that collecting at sunflowers gives only incomplete picture of fauna, & that presence of sunflowers alters composition of collections made nearby by other methods. [P. B.]

Kramer, John Paul, "The effects of extremes in temperature on populations of *Pyrausta nubilalis* (Hbn.) infected with *Perezia pyraustæ* Paillot." *Bull. ent. Soc. Amer.,* vol.3: p.27. 1957. Abstract.

Kratochvíl, Josef, "Málo známý škůdce sušené papriky, zeleniny a léčivých bylin" [in Czech; French & Russian summaries]. *Ochrana Rostlin,* vol.19/20: pp.49-54. 1948. *Acidalia herbariata* (Geometridæ) as pest of dried red pepper, vegetables, and curative herbs in storehouses and warehouses. Indoors this species has four generations per year. [J. M.]

Krauss, Noel L. H., "Notes on insects associated with Lantana in Cuba." *Proc. Hawaiian ent. Soc.,* vol.15: pp.123-125. 1953. Records *Syngamia hæmorrhoidalis,* on leaf; *Platyptilia* sp., *Crocidosema* sp., & *Epinotia lantana,* on berries. [P. B.]

Krieg, Aloysius, "Eine Microsporidie aus dem kleinen Frostspanner (*Cheimatobia brumata* L.)" [in German]. *Naturwissenschaften,* vol.43: p.186, 2 figs. 1956. Describes new protozoan parasitizing this sp. [P. B.]

Krieg, Aloysius, & Richard Langenbuch, "Eine Polyhedrose von *Aporia cratægi* L. (Lepidoptera). I. Mitteilung" [in German; English summary]. *Zeitschr. Pflanzenkrankh.,* vol.63: pp.95-99, 3 figs. 1956. Describes a new virus & disease produced. [P. B.]

Krieg, Aloysius, "Virus-Isolierung aus kranken Larven von *Hibernia defoliaria* L. und *Euproctis chrysorrhœa* L." [in German]. *Naturwissenschaften,* vol. 43: pp.260-261, 2 figs. 1956. Describes 2 new viruses from these moths. [P. B.]

Krieg, Aloysius, "Über Aufbau und Vermehrungsmöglichkeiten von stäbchenförmigen Insekten-Viren" [in German; English summary]. *Zeitschr. Naturforsch.,* vol.12b: pp.120-121. 1957. Structure of pathogen of *Aporia cratægi.* [P. B.]

Kruel, Walther, "Der Kiefernspinner, ein Katastrophenschädling. Bemerkungen über den Stand seines Massenauftretens und die Wege zu seiner Bekämpfung" [in German]. *Forstwirtsch., Holzwirtsch.,* vol.2: pp.199-203, 3 figs. 1948. Biology & control of *Dendrolimus pini.* [P. B.]

Krutch, Joseph Wood, "Monarch of the skies." *Natural Hist.,* vol.66, no.1: pp.24-27, 7 figs. 1957. Life history of *Danaus plexippus.* [P. B.]

ERRATA

Two important errors were printed in the abstract of MARION's first paper in the preceding issue of the *Journal* (page 76). In the 10th and 12th lines, the correct spellings of two new species are *Trigonuncus flavipunctalis* (not ""*flavopunctalis*") and *Amahona fusconebulalis* (not "*fusconebulis*").

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JOURNAL OF
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Volume 16 1962 Number 3

A HYBRID BETWEEN *PAPILIO ÆGEUS ÆGEUS* AND *PAPILIO FUSCUS CAPANEUS*, WITH A NOTE ON LARVAL FOODPLANTS

by R. STRAATMAN

Papilio ægeus Donovan and *Papilio fuscus* Goeze are closely related species. They are very similar in their morphology, but differ markedly in one respect, namely that the former shows sexual dimorphism while the other does not. *P. ægeus* occurs in various races throughout New Guinea and in Eastern Australia as far south as Canberra, while *P. fuscus* is rather more widely distributed extending westwards into the Indo-Malayan region, but in Australia southwards as far as Brisbane.

In south-eastern Queensland *P. ægeus ægeus* is a common species, the larvæ occurring on a variety of rutaceous plants in several genera. *P. fuscus capaneus* Westwood, however, is usually less common and may not be seen for several years. Its larvæ have been found on only a few species of rutaceous plants. (See Table 1A)

During 1959, both species were common in the Brisbane area and attempts were made to cross-mate them, as described below. Generally results follow the pattern reported by other workers with this genus, e. g. REMINGTON (1960) and AE (1960). The matings were carried out by fixing the individual specimens very gently on the top of blocks of balsa wood. The closed wings were covered with paper strips, fixed with a pin at each end, while the legs and lower parts of the abdomen protruded from the side of the block. A male and a female were then brought together and the anal claspers of the male gently opened with a pair of forceps. The abdomen of the female was then pushed between the claspers taking great care to lock the claspers in the right position. The successfully mated female was kept in a dark box for five to six days and fed daily with a 10% to 15% sucrose solution. She was then released in a large cage in which young shoots of *Citrus* were placed.

The first experiments using males of *P. fuscus* and females of *P. ægeus* were unsuccessful. This was possibly due to the anal claspers of the males being rather small and thus having little or no grip on the anal segments of the females. Only in one instance did copulation succeed, but the spermatophore was lost.

The experiment was then reversed and a small male of *P. ægeus* was successfully mated with a relatively large female of *P. fuscus*. The oviposition gave the following results:

Date of oviposition	Eggs laid	Eggs hatched	
September 15	16	11	
September 19	15	5	
September 21, 22	45	36	
Totals	76	52	(hatchability 68.4%)

After oviposition, the eggs were fixed to a filter paper by applying a very weak solution of gum to their flattened base, and kept in a petri dish until they hatched. This method gave excellent results. As soon as the larvæ hatched, they were divided into three groups, each of which was kept in a petri dish and was offered a different host plant. Those to be reared singly were isolated when they reached the second instar.

Of the 52 larvæ, 16 were reared singly and the remainder together. Mortality was highest amongst the individually reared specimens, of which only 13 reached maturity, and of these only one pupated normally. The others failed to produce the silk girdle for pupation and lay as prepupæ at the bottom of their cage. They were therefore helped into girdles of exuviæ, and as a result 6 of them proceeded to pupate. The others were deformed and perished. The 36 specimens reared together showed a low mortality; 26 reached maturity, of which 22 pupated normally and only 4 failed to produce the silk girdle. Larvæ were reared on three different hostplants: a) citrus (*C. reticulata*), b) parsley (*Petroselinum crispum*) and c) camphor laurel (*Cinnamomum camphora*) with the results shown in Table 2.

The 9 specimens reared together on camphor laurel died in their early instars although they accepted this host readily. Feeding experiments carried out at the same time with larvæ of *P. ægeus* showed similar ill-effects after eating camphor laurel leaves grown in the spring. Previous experiments with *P. ægeus* conducted at a different time of the year gave good results, and it seems possible that a concentration of toxic elements builds up in the buds of the camphor laurel during the winter months, thus causing the death of larvæ feeding on the resulting leaves in the spring (Stride & Straatman 1962).

Table 1. HOST PLANT OBSERVATIONS ON *PAPILIO ÆGEUS* & *FUSCUS*

A. Host plants on which wild females of both species have been observed to oviposit or on which larvæ were collected in the field. All are Rutaceæ. (Asterisk indicates introduced plants.)

Papilio ægeus ægeus	*Papilio fuscus capaneus*
* *Citrus aurantium* L.	* *Citrus aurantium*
* *C. sinensis* (L.) Osbeck	* *C. sinensis*
* *C. reticulata* Blanco	* *C. reticulata*
* *C. limon* (L.) Burm.	* *C. limon*
* *C. paradisi* Macfayden (occasional larvæ)	* *C. aurantiifolia*
* *C. aurantiifolia* (Christm.) Swingle	*Microcitrus australasica*
* *Choisya ternata* H. B. et K.	*Zanthoxylum brachyacanthum*
Flindersia bennettiana F. Muell.	
F. collina F. M. Bail.	
Microcitrus australasica (F. Muell.) Swingle	
M. australis (Planch.) Swingle	
Geijera salicifolia Schott	
Zanthoxylum brachyacanthum F. Muell.	

B. Other plants, accepted in the laboratory by larvæ of *P. ægeus,* but not by *P. fuscus.*

Rutaceæ	Umbelliferæ
Flindersia xanthoxyla Domin.	* *Daucus carota* L.
F. australis R. Br.	* *Petroselinum crispum* (Mill.) Nyman.
Meliaceæ	* *Apium graveolens* L.
Owenia venosa F. Muell.	Capparidaceæ
Lauraceæ	*Capparis nobilis* F. Muell.
* *Cinnamomum camphora* (L.) T. Nees et Eberm.	Aristolochiaceæ
	* *Aristolochia elegans* Mast.

C. Rutaceous plants not accepted by either species in the laboratory.

Evodia micrococca F. Muell.
Medicosma cunninghamii (Hook.) Hook. f.
Acronychia baueri Schott
A. pauciflora C. T. White

Table 2. SURVIVAL OF F_1 HYBRID LARVÆ ON VARIOUS FOOD PLANTS

	Number of larvæ tested on: Citrus[1]	Parsley[1]	Laurel[1]	Died as pre-pupæ	Total tested	Total died	Total pupated
Singly	11 [1]	5 [2]	0 [0]	6	16	9	7[2]
Grouped	18 [0]	9 [1]	9 [9]	4	36	14	22
Totals:	29 [1]	14 [3]	9 [9]	10	52	23	29

[1]In brackets is the number of these that died as larvæ.

[2]Six of these pupated when assisted (see text).

The 29 pupæ produced 26 males and 3 females. The males emerged normally but the 3 females, although fully developed, were unable to emerge.The males were large in comparison with the size of their pupæ; 15 of these were used for back-crossing to females of both parent species. In most cases copulation was normal and the mated females produced a large number of eggs, but all were sterile.

Description of Larvae

I. First Instars.

A. *P. fuscus*: - Head black with short setæ. Ground colour yellowish grey. First thoracic segment orange yellow dorsally and with four tubercles of which the two dorsal ones the longest, yellowish white and with stiff whitish hairs; lateral tubercles short, brown with hairs. Remaining thoracic segments each with six tubercles, of which the dorsal ones the longest, yellowish, with whitish hairs; lateral tubercles rather short, brown. Abdomen yellowish grey; third segment white dorsally and ventrolaterally down to the prolegs; fourth and ninth segments white dorsally. All abdominal segments with six rather short tubercles, the dorsal ones on the eighth and ninth rather longer and yellowish white. Legs black, prolegs brown. When moult nears, the general appearance is shiny brown.

B. *P. ægeus*: - Head black with short setæ. Ground colour brownish black. First thoracic segments white dorsally and dorso-laterally and with six tubercles at the lateral, latero-dorsal and dorsal levels respectively; the latero-dorsal tubercles white and larger than any other tubercles of the larva. Second thoracic segment white dorsally and the third white dorso-laterally, with eight tubercles each, of which the dorso-lateral ones are white on the second and black on the third thoracic segments. Abdomen: first, second, fifth, sixth and seventh abdominal segments brown-black, with black tubercles, eight on the first and six on the others; third fourth, eighth and ninth segments white dorsally and dorso-laterally, with six white tubercles each, those on the eighth and ninth the longest; all tubercles have spines and hairs; anal segments with black setæ. Underside uniformly black.

C. Hybrid: - Head black with short setæ. First thoracic segment white, with four tubercles at the lateral and dorso-lateral levels, those at the latter level the longest, white and inclined posteriorly. Second and third thoracic segments dark greyish brown with six small black tubercles each. Abdomen: first and second segment dark brown, with six short black tubercles each, the dorsal ones slightly longer; third, fourth, eighth and ninth segments yellowish white with six short tubercles each, the dorsal ones on the eighth and ninth the longest; fifth, sixth and seventh segments dark grey-brown, tubercles black, rather short; all tubercles are fleshy with greyish hairs and black spines; anal segments and underside of all segments dark brown. Legs black, prolegs brown.

II. The Intermediate Instars.

A. *P. fuscus*: - Head black with short setæ. From the second to the fourth instar, the ground colour becomes gradually browner. Dorsal tubercles of first thoracic segment orange brown, fleshy with short stiff hairs. Tubercles of second and third thoracic segments rather short, brown. Abdominal segments paler brown dorsally; tubercles rather short, brown, those on the eighth and ninth abdominal segments longer, orange-brown; all tubercles have a bluish dot near the base; a white area is present laterally on the second, third, fourth, seventh and eighth abdominal segments; on the third segment it extends transverse-dorsally and laterally. Prolegs dark grey, white laterally, and with dark spots between them.

B. *P. ægeus*: - In the intermediate instars, of which no detailed description was made, the ground colour varies from greenish ash-grey to almost black. The white dorsal and lateral areas are distinct. Tubercles comparatively much longer than in *P. fuscus*. Small, irregular stripes and spots are present, and in the penultimate instar there are blue spots dorsally. All these marks vary considerably in shape and density.

C. HYBRID: - Head shiny black, with fewer setæ than in the first instar. Second instar with first thoracic segment white and with two long white fleshy tubercles, inclined posteriorly. Second thoracic segment light brown dorsally, with white markings and short brown tubercles. Third thoracic and first abdominal segments dark coffee-brown with two short dorsal and two rather short lateral tubercles. Other abdominal segments dark brown. White areas extend dorsally on the third and eighth, dorso-laterally on the fourth and seventh, and ventro-laterally on the sixth abdominal segments. Tubercles rather short, brown, except those on the seventh and eighth abdominal segments, which are longer and white.

In the third and fourth instars the colour becomes gradually yellowish brown, white markings more distinct and tubercles shorter. Those on the first thoracic segment yellow and the abdominal tubercles have a small, blue sub-basal dot. The second abdominal segment broad white laterally, and a broad, white subspiracular stripe runs posteriorly from the third abdominal segment. Legs black, prolegs greyish.

III. THE FINAL INSTARS.

A. *P. fuscus*: - There are two forms, of which the brown form is the most common.

Brown Form. Head pale greenish brown. Ground colour orange-brown. Thoracic and the first two abdominal segments with a ventro-lateral dark brown area, extending laterally, but narrowing dorsally on the posterior margin of the first abdominal segment, thus forming a ring, which however is not as wide and distinct as in *P. ægeus* larvæ. First two thoracic segments have the dorsal margin of this dark area boardered by creamy yellow, which fades out into a few indistinct stripes on the third thoracic segment. Two fleshy short tubercles present on the first thoracic and on the eighth and ninth abdominal segments, these tubercles brown and tipped with yellow. All other segments smooth. Dorsally the thoracic segments have four and the abdominal segments six round, blue spots. A broad white to pinkish subspiracular stripe runs from the

second abdominal to the anal segments, extending postero-laterally on the fourth abdominal segment to form a wedge-shaped spot. This spot has its dorsal margin broadly marked with dark brown, forming a saddle-mark, which however is not as distinct as in *P. ægeus*. A much smaller dark brown spot is present at the base of the anterior end of the sixth abdominal segment. All segments with small, whitish dots and irregular stripes dorsally and laterally, forming a more distinct yellowish white area on the seventh and eighth abdominal segments. Anal segments dark brown with yellow markings. Legs ochreous, prolegs light grey.
Green Form. Head ochreous green. Yellowish white markings and blue spots reduced and indistinct, giving the larva a uniform green appearance. The dark brown markings however are much more distinct than in the brown form, while the subspiracular stripe is broader and more pinkish. The dorsal tubercles on the eighth and ninth abdominal segments are smaller than in the orange form, and green. Legs yellowish green, prolegs white.

B. *P. ægeus*: - The most common form is green in colour, usually with numerous irregular yellowish white oblique stripes and dots. These vary individually and are sometimes totally absent. First thoracic segment with six tubercles, remaining thoracic and the first abdominal segments with eight tubercles each, the latero-dorsal pairs being the longest. All other abdominal segments have two tubercles dorsally, which are black on the fifth, sixth and seventh segments and yellowish green on the others. The brown ventral area on the thoracic segments extends laterally and narrows dorsally on the posterior half of the first abdominal segment, forming a distinct ring. The intersegmental membrane between the first two abdominal segments velvet-black, but only visible when larva is disturbed. A distinct, olive brown saddle-mark runs from the dorso-lateral region of the fifth segment down to the ventro-lateral region of the fourth segment, while a similar but much smaller mark is present anteriorly on the ventro-lateral part of the sixth abdominal segment. Anal segments marked with black and yellow. Subspiracular stripe broad and pinkish white. Legs olive brown, their dorsal margin white. Prolegs pinkish pale green, the first pair broadly the others narrowly marked with a transverse black stripe. A second form is more yellowish green with the white markings broader and very distinct. The dark areas, including the saddle mark, are reduced. Some specimens have a pinkish white saddle mark.

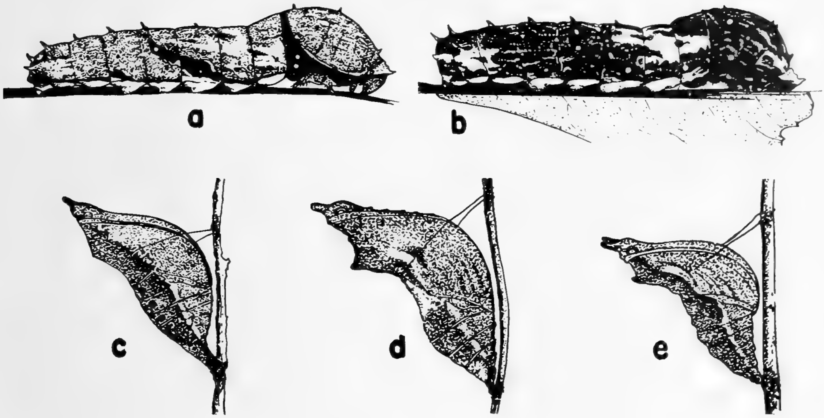
C. Hybrid: - As in *P. fuscus,* there were green and brown forms, the green one resembling *P. ægeus* and the brown form *P. fuscus.* In the

first form all segments are green, with numerous faint, yellowish irregular markings and two to four blue spots each, large on the first, fourth and fifth abdominal segments, but small on the others. A slightly more distinct, broad, whitish area extends laterally on the second and eighth and dorso-laterally on the third and fourth abdominal segments, where it fades out. With the exception of the second and third abdominal segments, all segments with two dorsal tubercles, each very short, yellow and without dark tips on the thoracic and the first abdominal segment, very short and green on the fourth segment, longest, yellow with black tips on the eighth and ninth segments, intermediate in length, dark green and with black tips on all other segments. Subspiracular white stripe broad on the fourth and sixth abdominal segment, but otherwise narrower than in the parent species' larvæ. A long, distinct, oblique, olive brown saddle-mark runs dorso-laterally from the fifth abdominal segment and widens laterally down to the anterior part of the fourth abdominal segment. It is bordered by two small white marks, a dorsal one on the fourth and a ventral one on the fifth segment. A similar dark stripe present at the anterior end of the sixth abdominal segment, below the spiracle. Anal segments marked with black. Legs greenish yellow, prolegs white. (See figure a, opposite.)

The orange-brown form has the thoracic segments with white longitudinal stripes dorsally. All other white markings broad and distinct, and the dark markings on the thoracic segments very broad. Blue spots large and distinct on the first, second, fourth and fifth abdominal segments. (See figure b, opposite.)

IV. THE PUPAE.

A. *P. fuscus*: - The colour is usually green, rarely light brown. Intermediate forms have not been recorded. Pupa smooth and rather broad dorsally, its greatest width about half of the total length. Head with two short anterior horns, which diverge slightly and are dark pinkish brown in colour. The dorsal bend rather shallow and without a mid-dorsal thoracic process. Ventrally the pupa is green, without markings. The inner margin of the wingcases bordered by a row of pinkish white spots, which continues on the abdominal segments as a definite stripe, pinkish brown in colour and with its dorsal and ventral margin bordered by white. Cremaster broad, and dark pinkish brown. Dorsally, the first seven abdominal segments with four distinct greenish black dots each, the eighth segment with only two dots and the following segments none. The silk girdle rather weak and often breaks. However, the pupa is strongly supported by the cremaster, which is flattened and sufficiently

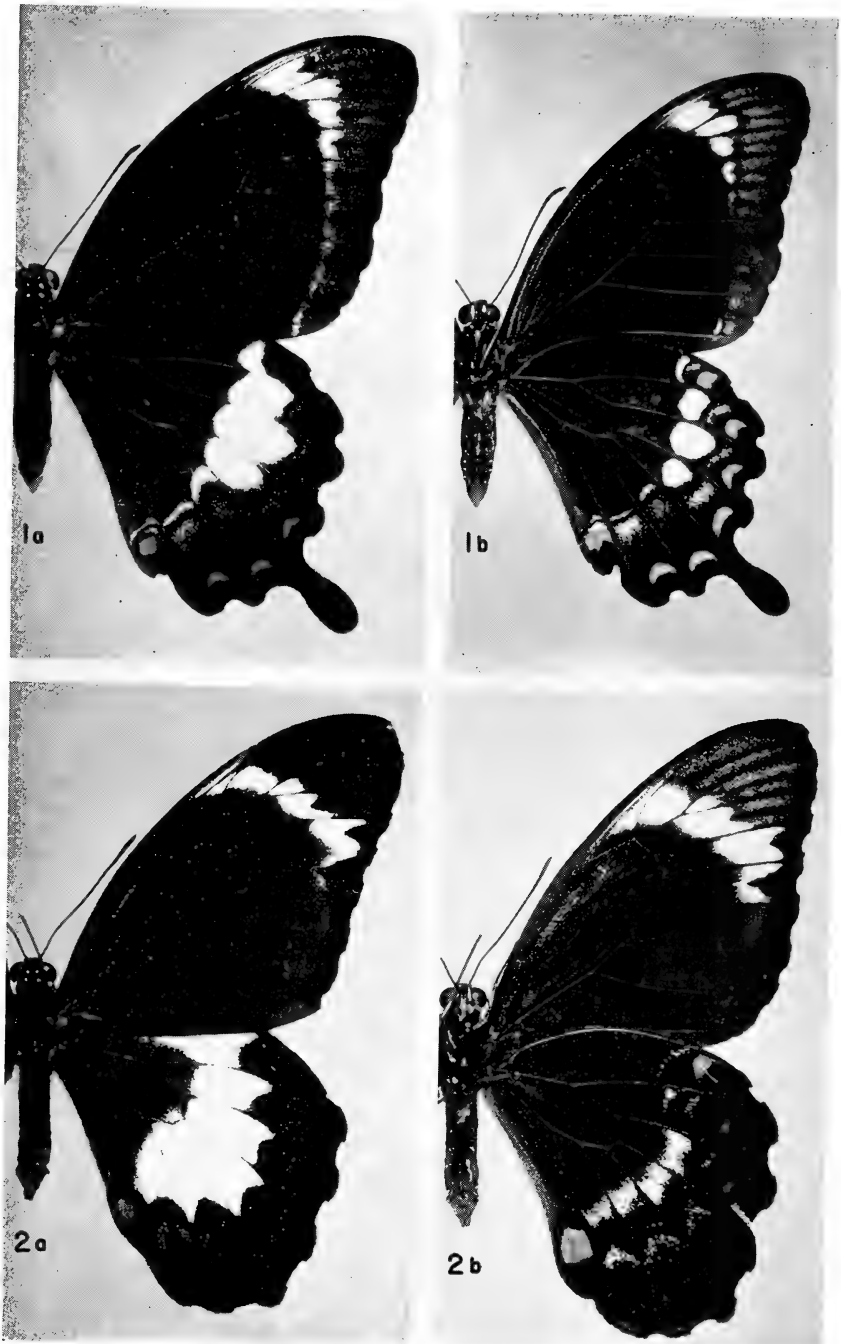


a) mature larva, F_1 hybrid (♀ *Papilio fuscus* × ♂ *P. ægeus*), green form; b) same, brown form; c) pupa, *Papilio fuscus;* d) pupa, *P. ægeus;* e) pupa, F_1 hybrid (♀ *P. fuscus* × ♂ *P. ægeus*).

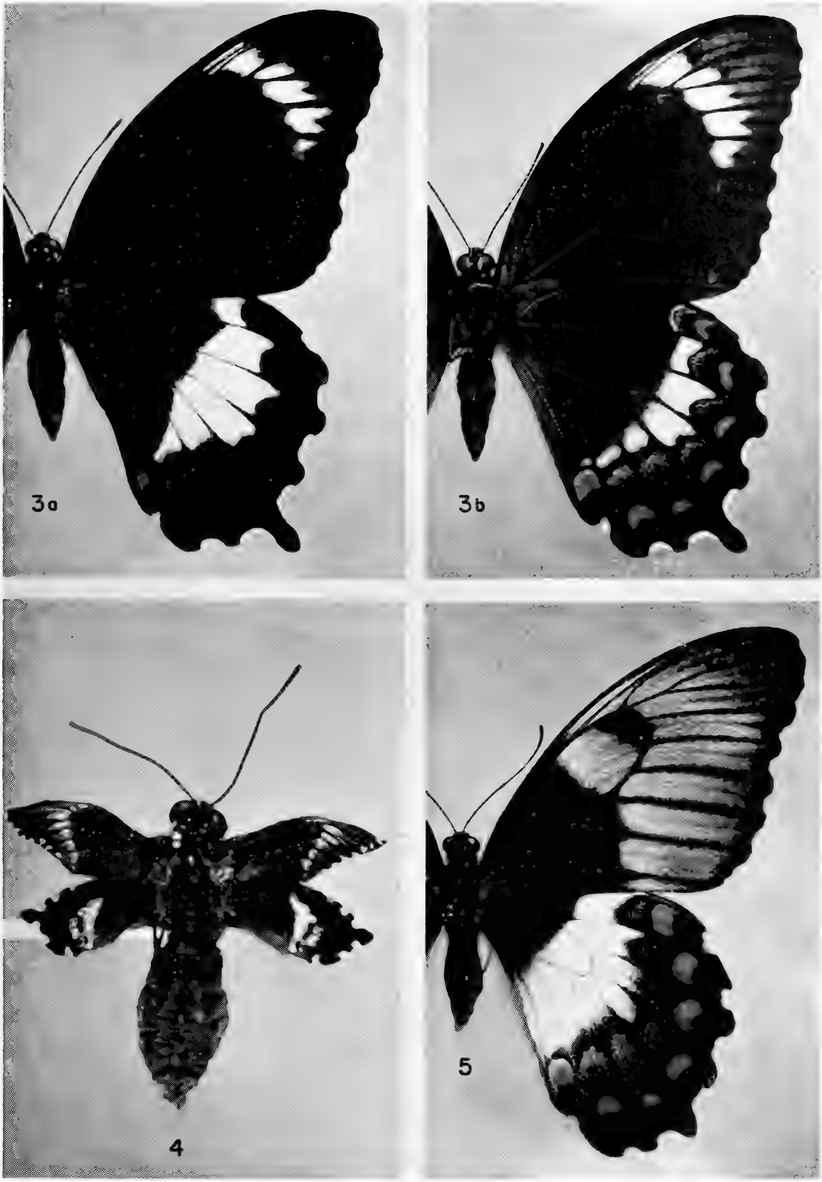
strongly attached to hold the pupa erect. The duration of the pupal stage varies greatly and may be several years. The pupa is sluggish and does not move when disturbed.

B. *P. ægeus*: - Ground colour varying from whitish grey to almost black, or bright green. The mid-dorsal thoracic process small and directed a little forwards. Dorsal bend sharply curved. Green pupæ have a broad lemon-yellow saddle-mark on the first three and a smaller, similar mark on the last three abdominal segments. Usually the wing-cases with a whitish streak on their inner margin and the abdominal segments with a similar strip laterally. Ventrally, four tiny tubercles present on the legs, and dorsally the fourth and fifth abdombinal segments with two short, blunt humps each. The cremaster smaller and weaker, while the silk girdle stronger than in *P. fuscus;* if the girdle breaks, the pupa falls forward. The pupal stage lasts for a minimum of 13 days and may last several months (in winter).

C. Hybrid: - The pupa of the hybrid variable in colour. As in *P. ægeus* the dorsal bend sharply curved. Mid-dorsal thoracic process short, dark brown and directed straight forward. Abdominal segments rounded dorsally, but without humps. Head with the two anterior horns, these slightly longer than in either parent and tipped dark brown. As in *P. fuscus,* abdominal segments with a distinct pinkish lateral stripe and with faint black dots dorsally. The brown pupæ with all markings faint. Pupa, sensitive especially when disturbed. Duration: 14-17 days.



1a) *Papilio fuscus* ♂, upperside; 1b) same, underside; 2a) *P. ægeus* ♂, upperside; 2b) same, underside.



3a) ♂ F_1 hybrid (♀ *Papilio fuscus* × ♂ *P. ægeus*), upperside; 3b) same, underside; 4) ♀ F_1 hybrid, upperside (deformed due to inability to eclose); 5) *P. ægeus* ♀, upperside. The ♀ of *P. fuscus* closely resembles the ♂ (see Fig. 1a).

V. THE ADULTS.

A. *P. fuscus*: - The male resembles the female, showing the pattern as illustrated in Plate 1, figs. 1a, 1b. Both sexes have tailed hindwings.

B. *P. ægeus*: - Sexually dimorphic. The females (Plate 2, fig. 5) are usually larger than the males and vary greatly in colour. Nearly white forms have been described. Males (figs. 2a, 2b) however are constant in their colour pattern. Both sexes are without tails on the hindwings.

C. HYBRID: - Adult males (figs. 3a, 3b) show a general appearance which is intermediate between that of the parental species and have short tails on the hindwings. On the dorsal surface the pattern closely approaches that of *P. ægeus* while on the ventral surface the pattern is rather more like that of *P. fuscus*. As far as can be judged from the unexpanded wings of the female (fig. 4), their pattern is also intermediate between the parent species.

A series of specimens has been lodged in the Division of Entomology Museum, C.S.I.R.O., Canberra.

DISCUSSION

The production of viable hybrids between *P. ægeus* and *P. fuscus* confirms the close relationship of these two species which is also apparent from their morphology. As is usual in these crosses (*e.g.* Remington, 1960; Ae, 1960), the hybrids were all sterile when tested by backcrossing, and almost all of them were males. The latter is an obvious example of Haldane's Rule.

However, unlike the *P. xuthus* crosses made by the two authors mentioned above, a small number of females were produced, which appeared quite normal until the time of eclosion and managed to rupture the pupal case, but could not go further.

At all stages the hybrids were intermediate between the two parents. Several features are noteworthy. The upper surface wing pattern of the hybrids for example resembled one parent while the under surface resembled the other. The presence of a hindwing tail was also intermediate between the two species. The hybrid larvæ, like the parents, showed two colour forms. Although most of the larval characters were intermediate between those of the two parent species in colour, one form resembled most closely the green form of *P. ægeus* while the other resembled the orange form of *P. fuscus*. In both forms however,

tubercles were present but smaller than in *P. ægeus,* and both forms also resembled that species in their willingness to accept certain foodplants. A further point of interest is the difference between specimens reared singly and those reared in a group in their ability to form the silk girdle for pupation. Whereas only one specimen out of the 13 reared singly pupated normally (Table 2), 22 out of 26 of those reared in a group formed the silk girdle and pupated normally. The difference is striking but its cause remains obscure.

A further feature of the hybrid larvæ was their resemblance to *P. fuscus* in the degree they were parasitized by tachinid flies. Whereas *P. ægeus* was heavily parasitized, *P. fuscus* was rarely attacked and the hybrid not at all. The eggs of the parasite, which are laid on the leaves of the foodplant, are ingested by the larvæ while feeding (Stride & Straatman, 1962). It may be that the degree of parasitization is correlated with the size of the mouthparts, the latter being greater in *P. ægeus* than in either *P. fuscus* or the hybrid.

Summary

1. A female of *Papilio fuscus* was successfully paired with a male of *P. ægeus,* but attempts at reciprocal pairings failed.

2. Adult, but sterile, male offspring were produced, but of the females reared, none emerged from the pupæ unaided.

3. Larval and pupal characters were intermediate, and the larvæ showed two colour forms. Larvæ accepted several foodplants which were also accepted by *P. ægeus* but not by *P. fuscus.*

4. The hybrid adults had short hindwing tails and in pattern resembled *P. ægeus* on the upperside of the wings and *P. fuscus* on the underside.

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Doa Estate, Private Mailbag, Port Moresby, PAPUA

BUTTERFLIES AT LIGHT IN NORTH CAROLINA AND PENNSYLVANIA

Two male *Calycopis cecrops* were taken at powerful lights near Asheville, North Carolina, July 18, 1960. A male *Speyeria diana* was taken at the same place June 27, 1961. All were taken between midnight and 2:00 a.m. and were nearly perfect. A perfect male *Wallengrenia otho* was taken at blacklight in suburban Philadelphia, August 18, 1961, a cool misty night.

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NORTH AMERICAN SPECIES OF THE GENUS *EANA*, WITH A GENERAL REVIEW OF THE GENUS, AND DESCRIPTIONS OF TWO NEW SPECIES (TORTRICIDÆ)

by Nicholas S. Obraztsov

Two of the Tortricidæ species, *argentana* Clerck and *osseana* Scopoli, usually treated in the American literature as members of the genus *Cnephasia* Curtis, belong, in accordance with new data, to the genus *Eana* Billberg. This Holarctic genus includes a total of 35 species (Obraztsov, 1955, 1956; Razowski, 1958, 1959a, 1959b, 1961). Of these 33 are the Palearctic species; the remaining two, the above-mentioned *argentana* and *osseana*, have a Pan-Holarctic range. In addition to this number, two more North American species are described as new in the present paper. These two species have to be regarded as obviously endemical of the Nearctic fauna.

The genus *Eana* has already been clearly defined in the recent literature, and there is no reason to return to this problem in the present paper. The new data, accumulated in the papers of Razowski, give a chance to improve the subgeneric classification of this genus. The present author is satisfied in having the opportunity to list all known *Eana* species in accordance with this new classification, and to review in detail the North American species of this genus.

The work for this paper was done under the auspices of the National Science Foundation.

Key to the Subgenera

1. Uncus distinctly differentiated into a narrow, oblong apical portion, and a strongly dilated, well separated base with flat "shoulders" on top of tegumen .... Subgenus *Eana* Billberg

   Uncus more or less coniform, or with a base forming oblique "shoulders" on top of tegumen 2

2. Uncus slender in apical portion, and with oblique "shoulders" on top of tegumen; gnathos simple; ædœagus with a large, triangular thorn, resting near its distal end. Sterigma broad, with posterior angles directed caudad; antrum broadly tubular .... Subgenus *Ablabia* Hübner

   Uncus more or less coniform, gradually dilated basad; gnathos with a middle process; ædœagus smooth. Sterigma rather narrow, with posterior angles directed laterad or slightly cephalad; antrum infundibuliform. .... Subgenus *Subeana*, new subgenus

LIST OF THE HOLARCTIC *Eana* SPECIES

The present list is merely a systematic index of the known *Eana* species, and does not include any original citations and the synonymy of the species already reviewed by OBRAZTSOV (1956) and RAZOWSKI (1959a). The above papers of these authors are indicated in the list as "O." and "R.", respectively.

Subgenus *Ablabia* Hübner, 1825

Type: *Phalæna osseana* Scopoli, 1763.

The characters of this subgenus are as described in the above key. A detailed review of the North American species is given in this paper.

argentana Clerck, 1759
- subspecies *argentana* Clerck, 1759 (O., p. 120; R., p. 274) — Palearctic region; India; North America.
- subspecies *plumbeana* Kennel, 1910 (O., p. 120) — Northeastern Asia.
- subspecies *colossa* Caradja, 1916 (O., p. 120) — Central Asia.

subargentana, new species
- Described in this paper — North America.

osseana Scopoli, 1763
- subspecies *osseana* Scopoli, 1763 (O., p. 120; R., p. 275) — Palearctic region; North America.
  - form *impunctana* Strand, 1901 (O., p. 120; R., p. 275) — Palearctic region; North America.
- subspecies *darvaza* Obraztsov, 1943 (O., p. 120) — Pamir.
- subspecies *niveosana* Packard, 1866 (O., p. 120) — Boreal America.

idahoensis, new species
- Described in this paper — North America.

Subgenus *SUBEANA* Obraztsov, NEW SUBGENUS

Type: *Sciaphila canescana* Guenée, 1845.

Male: Uncus more or less coniform, gradually dilated basad; gnathos with a middle process. Ædœagus smooth.

Female: Sterigma rather narrow, with posterior angles directed laterad or slightly cephalad. Antrum infundibuliform.

Remarks: RAZOWSKI (1959a) treated the species of this subgenus as "Group 1" of his broadly interpreted subgenus *Eana*.

rielana Réal, 1951 (O., p. 121; R., p. 278) – Southern France.
hungariæ Razowski, 1958 (R., p. 279) – Hungary.
canescana Guenée, 1845 (O., p. 120; R., p. 279) – Europe.
form *montserrati* Réal, 1953 (O., p. 121; R., p. 280).
form *candidana* Laharpe, 1858 (O., p. 121; R., p. 280).
form *venansoni* Réal, 1953 (O., p. 121; R., p. 280).
filipjevi Réal, 1953 (=*pyrenaica* Toll, 1954; *livonica* Réal, 1953, in part) (O., p. 121, 122; R., p. 280, 282, 288) – Southwestern France.

Subgenus *Eana* Billberg, 1821

Type: *Tortrix penziana* Thunberg & Becklin, 1791.

The characters of this subgenus are as described in the key.

Remarks: RAZOWSKI (1959a) distributed the species of this subgenus among two groups of his broadly interpreted subgenus *Eana*. As "Group 2" he treated the species related to *nervana* Joannis. He characterised them as having a short sacculus, terminated with a minute, separate tip, and an ædœagus bearing a small, knob-like terminal thorn. Moreover, he found the antrum of the females as being less sclerotized, with the sclerotization occupying a small area. As "Group 3" RAZOWSKI treated the remaining species which did not have the above-mentioned characters. The present author cannot agree with this group distribution of the species, because he finds their characters insufficient for a distinct separation of one group from the other. And really, in *derivana* Laharpe (a member of RAZOWSKI's "Group 3") the length of the sacculus occupies an intermediate position between the two groups. The sclerotization of the antrum is rather variable in the "Group 3", and in many cases practically cannot be distinguished from that in the "Group 2." The only distinction between these two groups consists merely of the presence of a terminal thorn on the tip of the ædœagus in the "Group 2," but this character is hardly adequate to justify a subgeneric separation of the species having it. Furthermore, some species of the "Group 3"

also have some sculpture on the ædœagus, although it is present on the lateral surface of the ædœagus, remote from its tip.

nervana Joannis, 1908 (O., p. 123; R., p. 283) – Southern France; Spain.
form *subnervana* Razowski, 1956 (R., p. 283).
italica Obraztsov, 1950 (O., p. 122; R., p. 284) – Italy; Macedonia.
maroccana Filipjev, 1935 (O., p. 123; R., p. 283; Razowski, 1956, p. 206, figs. 3, 4; pl. 20, figs. 1, 2) – Morocco; Greece; Italy.
cottiana Chrétien, 1898
subspecies *cottiana* Chrétien, 1898 (O., p. 123; R., p. 285) – South-eastern France; Switzerland.
form *buvati* Réal, 1953 (O., p. 123; R., p. 285).
subspecies *pyrenæa* Réal, 1953 (O., p. 123; R., p. 286) – Southern France.
rastrata Meyrick, 1910 (O., p. 122; R., p. 302; Clarke, 1958, p. 88, pl. 44, figs. 3-3b) – Switzerland.
schönmanni Razowski, 1959 (p. 85, fig. 7; pl. 3, fig. 6) – Morocco.
kuldjaënsis Razowski, 1959 – Central Asia.
penziana Thunberg & Becklin, 1791
subspecies *penziana* Thunberg & Becklin, 1791 (O., p. 122; R., p. 287) – Palearctic region.
form *bellana* Curtis, 1826 (O., p. 122; R., p. 287).
form *alpestris* Réal,, 1953 (O., p. 122; R., p. 288).
form *amseli* Razowski, 1959 (R., p. 288).
subspecies (?form) *colquhounana* Barrett, 1884 (O., p. 123; R., p. 288) – British Islands; Eastern Europe.
subspecies *fiorana* Razowski, 1959 (R., p. 289) – Italy.
viridescens Razowski, 1959 (R., p. 290) – Northern Caucasus.
incanana Stephens, 1852 (O., p. 121; R., p. 291) – Europe.
infuscata Réal, 1953 (O., p. 121; R., p. 292; Razowski, 1961, p. 670) – Europe.
nevadensis Rebel, 1928 (R., p. 293; *nervana* [in part], O., p. 123) – Spain.
joannisi Schawerda, 1929 (O., p. 121; R., p. 293) – Corsica.
form *evisa* Schawerda, 1929 (O., p. 122; R., p. 294).
derivana Laharpe, 1858 (O., p. 122; R., p. 295) – Europe.
incognitana Razowski, 1959 (R., p. 296) – Switzerland.
jäckhi Razowski, 1959 (R., p. 297) – France.
rundiapicana Razowski, 1959 (R., p. 297) – “Bomisch.”
herzegovinæ Razowski, 1959 (R., p. 298) – Herzegovina.
cyanescana Réal, 1953 (O., p. 122; R., p. 298) – Southern France.

clercana Joannis, 1908 (O., p. 121; R., p. 299) – Southeastern France; Spain.
samarcandæ Razowski, 1958 – Central Asia.
pallifrons Razowski, 1958 – Mongolia.
viardi Réal, 1953 (O., p. 122; R., p. 301) – Southern France.
dumonti Réal, 1953 (=*legrandi* Réal, 1953, in part) (O., p. 122; R., p. 294, 300; Razowski, 1961, p. 671, fig. 1) – Southern France.

Species incertæ sedis

agricolana Kennel, 1919 (O., p. 123) – Central Asia.
antiphila Meyrick, 1913 (O., p. 123) – Tunisia.
biruptana Chrétien, 1922 (O., p. 121) – Morocco.
dominicana Kennel, 1919 (O., p. 123) – Central Asia.
vetulana Christoph, 1881 (O., p. 112; Razowski, 1961, p. 669) – Southeastern Siberia; Corea; Japan.

Eana (*Ablabia*) *argentana argentana* (Clerck)

Figures 1, 5

Argentana Clerck, 1759, *Icones insectorum*, pl.11, fig.14. Zeller, 1853, *Stettiner ent. Zeitg.* 14: 289. Werneburg, 1864, *Beiträge Schmetterlingskunde* 1: 230.

Phalæna (*Tortrix*) *goiiana* Linné, 1761, *Fauna Suecica*, ed.2: 349.

Phalæna (*Tortrix*) *gouana* Linné, 1767, Systema naturæ, vol.1, ed.12: 879. Gmelin, 1788, *Systema naturæ*, vol.1, ed.13: 2509. Villers, 1789, *Caroli Linnæi ent.* 2: 401.

Phalæna (*Tortrix*) *argentana*, Schiffermüller & Denis, 1775, *Ankünd. syst. Werk. Schmett. Wiener Gegend*: 127; 1776, *Syst. Verz. Schmett. Wiener Gegend*: 127. Illiger, 1801, *in* Illiger & Haefeli, *Syst. Verz. Schmett. Wiener Gegend*, vol.2: 46.

Pyralis govana Fabricius, 1775, *Systema ent.* 651; 1794, *Ent. syst.* 3, pt.2: 267.

Pyralis gouana, Fabricius, 1781, *Species insectorum.* 2: 283; 1787, *Mantissa insectorum* 2: 233.

Pyralis margaritalis Hübner, 1796, *Sammlung europ. Schmett. Pyralides*: pl.8, fig.48.

Tortrix argentana, Hübner, 1796-1799, *Sammlung europ. Schmett. Tortrices*: pl.14, fig.86. Charpentier, 1821, *Zinsler, Wickler, Schaben Geistchen syst. Verz. Schmett.*: 37. Meyrick, 1895, *Handbook Brit. Lepid.*: 142. Walsingham, 1900, *Ann. mag. nat. hist.*, ser.7, vol.5: 460. Fernald, "1902" [1903], *Bull. U. S. natl. mus.* 52: 484, no.5411. Kennel, 1910, *Palæark. Tortriciden*: 196, pl.10, fig.17. Matsumura, 1931, *6000 ill. insects Japan-Empire*: 1077, fig.

Tortrix magnana Hübner, 1811-1813, *Sammlung europ. Schmett. Tortrices*: pl.36, figs.225, 226. Zincken, 1821, *in Charpentier, Zinsler, Wickler, Schaben Geistchen syst. Verz. Schmett.*: 37.

Palpita margaritalis, Hübner, 1822, *Syst.-alphabet. Verz.*: 55.

Eutrachia magnana, Hübner, 1822, *op. cit.*: 62.

Ablabia magnana, Hübner, 1825, *Verz. bek. Schmettlinge* [*sic*]: 383.

Tortrix gouana, Treitschke, 1830, *Schmett. Europa* 8: 102; 1835, *Schmett. Europa* 10, pt.3: 248. Zeller, 1839, *Isis*: 327. Werneburg, 1864, *Beiträge Schmetterlingskunde* 1: 195.

Argyroptera gouana, Duponchel, 1836, *Hist. nat. lépid.* 9: 444, pl.259, fig.7; 1846, *Cat. méthod. lépid. Europe*: 310.

Aphelia gouana, Guenée, 1845, *Ann. soc. ent. France* (sér.2) 3: 305; "1845" [1846], *Europ. Microlepid. index meth.*: 67.

Tortrix (Ablabia) gouana, Herrich-Schäffer, 1851, *Syst. Bearb. Schmett. Europa* 4: 177.

Sciaphila gouana, Lederer, 1859, *Wiener ent. Monats.* 3: 251.

Sciaphila (Ablabia) gouana, Heinemann, 1863, *Schmett. Deutschlands und Schweiz,* div.2, vol.1, fasc.1: 54.

Sciaphila (Ablabia) argentana, Wocke, 1871, *in* Staudinger & Wocke, *Cat. Lepid. europ. Faunengeb.* 240, no.770.

Ablabia gouana, Walsingham, 1879, *Ill. typical spec. Lepid. Het.* 4: 77.

Sciaphila argentana, Fernald, 1882, *Trans. Amer. ent. soc.* 10: 16. Grote, 1882, *New check list North Amer. moths*: 58, no.68.

Myelois georgiella Hulst, 1887, *Ent. Amer.* 3: 136.

Cnephasia argentana, Rebel, 1901, *in* Staudinger & Rebel, *Cat. Lepid. palæarc. Faunengeb.* 2: 91, no.1607. Meyrick, 1912, *Lepid. cat.*, pt. 10: p. 44; 1913, *Genera insectorum,* fasc.149: 44. Barnes & McDunnough, 1917, *Check list Lepid. Boreal America*: 178, no.7402. Forbes, "1923" [1924], *Mem. Cornell Univ. agr. exp. sta.* 68: 488. Meyrick, 1927, *Rev. handbook British Lepid.*: 513. McDunnough, 1939, *Mem. so. California Acad. Sci.* 2: 58, no.7459. Benander, 1950, *Svensk insektfauna,* pt.10: p.47, fig.5a. Issiki, 1957, *in* Esaki *et al., Icones Heter. Japon.* 1: 82, pl.14, fig.432.

Aphelia argentana, Conquest, 1911, *Entomologist* 44: 156.

Nephodesme argentana, Pierce & Metcalfe, 1922, *Genitalia group Tortricidæ . . . British Islands*: 14, pl.6. Kremky, 1935, *Ann. mus. zool. Polonici* 11: 117.

Ablabia argentana, Busck, 1931, *Bull. Brooklyn ent. soc.* 26:210, pl.11, fig.9.

Cnephasia (Ablabia) argentana, Réal, 1953, *Bull. mens. soc. Linnéenne Lyon* 22: 52. Razowski, 1957, *Acta Zool. Cracov.* 1: 122, pl.15, fig.2; pl.20, fig.4; pl.24, fig.1.

Eana argentana, Obraztsov, 1955, *Tijdschr. Ent.* 98: 169, fig.285. Bradley & Martin, 1956, *Ent. Gaz.* 7: 154, pl.7.

Eana (Ablabia) argentana, Obraztsov, 1956, *Tijdschr. Ent.* 99: 120. Razowski, 1959, *Acta Zool. Cracov.* 4: 274, pl.26, fig.76; pl.47, fig.221; pl.61, fig.291. Hannemann, 1961, *Kleinschmetterlinge,* I. *Die Wickler, Tierwelt Deutschlands* 48: 44, fig.69, pl.5, fig.5.

TYPES: The location of types of *argentana* (?Patria), *goiiana* (Sweden), *margaritalis* (Europe), and *magnana* (Europe) is unknown. The names *gouana* and *govana* are only the spelling varieties for *goiiana.* The holotype of *georgiella* (Colorado) is probably lost.

Specimens examined: Many males and females from Europe, with genitalia slides, in the U. S. National Museum, British Museum (Natural History), and Zoological Collection of the Bavarian State. ALBERTA: Two males (genitalia of one on slide, No. 373-Obr.), Laggan, August 8-15 (Kearfott Collection); one male (genitalia on slide, No.370-Obr.), Waterton Lake, August 17, 1949 (W. J. & J. W. GERTSCH). WASHINGTON: One male, Chinook Pass, August 2, 1941 (Collection G. H. & J. L. SPERRY). COLORADO: Three males, Valley View Lodge, 7600 feet, 10

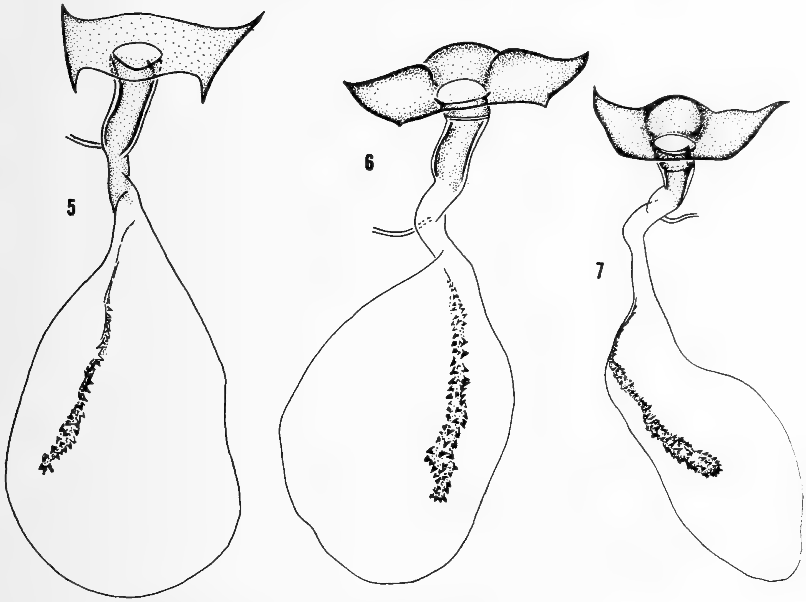
miles south Steamboat Springs, Routt County, July 13, 1956, and July 13, 1957 (F. & P. Rindge). IDAHO: 15 males, Alturas Lake, 7000 feet, Blaine County, July 25-27, 1956 (F. & P. Rindge); 10 males, North Fork Camp, 6200 feet, 9 miles N. W. Ketchum, Blaine County, July 22-23, 1956 (F. & P. Rindge); one male, Twin Creek Camp, 5200 feet, 5 miles N. Gibbonsville, Lemhi County, July 29, 1956 (F. & P. Rindge). WYOMING: One male, 12-16 miles S. W. Big Horn, 7700-8000 feet, Big Horn Mountains, Sheridan County, July 19, 1959 (F., P., & B. Rindge); one male, Ranger Creek Camp, 7800 feet, 18 miles S. W. Big Horn, Sheridan County, July 16, 1959 (F., P., & B. Rindge); one male, one female (genitalia on slide, No.142-Obr.), Yellowstone Park, July, 1900 (Barrison); 22 males (genitalia of one on slide, No.605-Obr.), Lower Green River Lake, 8000 feet, Wind River Range, Sublette County, July 30 - August 8, 1953 (F. & P. Rindge), August 3-6, 1959 (F., P., & B. Rindge); one male, Sacajawea Camp, 8400 feet, 24 miles W. Big Piney, Sublette County, August 1, 1959 (F., P., & B. Rindge); one male, Clear Creek Valley, 8000-8500 feet, Wind River Range, Sublette County, July 19, 1956 (F. & P. Rindge); one male, between Smith Creek and Rambler, 9400-9700 feet, Sierra Madre Mountains, Carbon County, August 10, 1959 (F., P., & B. Rindge); one male, Lake Creek Camp, 6900 feet, Park County, July 23, 1959 (F., P., & B. Rindge). All of the above North American specimens are deposited in the American Museum of Natural History.

Remarks: It is somewhat questionable, whether the name *argentana* Clerck can be applied to this widely distributed Holarctic *Eana* species. The type of *argentana* does not probably exist any more, and the figure published by Clerck leaves some doubts that it represents the species, recently known under this name. The figured moth has the forewings much broader than they are in our *Eana* species. The antennæ are very thick and to all appearances pectinate. Moreover, the moth on the figure is somewhat larger than the *Eana* species in question. Especially suspicious is the fact that Clerck's *argentana* was never mentioned by Linne, although in his later papers he cited most of the species figured by Clerck. For the species, figured by Clerck as *argentana,* he proposed the name *goiiana* (Linné, 1761), changed later to *gouana,* without any reference to Clerck's figure. Neither was the name *argentana* mentioned by Gmelin, Fabricius, or other contemporary authors. Less important is the fact that *argentana* was published by Clerck as a uninominal name, because the International Commission on Zoological Nomenclature will probably find some ways for validation of Clerck's paper, where the binominal principles were completely ignored.

Figs. 1-4. Right valvæ of North American *Eana* species. 1. *E. argentana argentana* (Clerck). 2. *E. subargentana,* new species. *E. osseana niveosana* (Packard). 4. *E. idahoensis,* new species.

Only because SCHIFFERMUELLER and DENIS (1775) used the name *argentana* for our tortricid species, the later authors identified this name with that of CLERCK. It is quite reasonable to think, that SCHIFFERMUELLER and DENIS, publishing this name, had in mind their own *argentana,* and never saw the paper of CLERCK, which always was an expensive and very rare book. In the interests of a stabilization of nomenclature, the present author would propose to disregard the considerations about the incertitude of the name *argentana* Clerck, and put it on the Official List of Specific Names in Zoology, in a commonly approved sense.

In spite of the above doubts about the nomenclature of the *Eana* species known as *argentana,* and the inaccessibility of the types of all synonyms of this species, the concept of this species is rather clear. Only in the case of the name *georgiella* Hulst might it be assumed that it belonged to *subargentana,* a new species described in this paper. The present author had an opportunity to see a male specimen in the U. S. National Museum, which originated from the Fernald Collection, was labeled as the "Type" of *georgiella,* and matched well the original de-



Figs. 5-7. Sterigmæ and bursæ copulatrices of North American *Eana* species. 5. *E. argentana argentana* (Clerck). 6. *E. subargentana*, new species. 7. *E. osseana osseana* (Scopoli).

scription of this species. This specimen showed itself as identical with *subargentana*. But the label data of this specimen were: Marohal Pass, 11,000 feet, Colorado, July 22, 1888. The description of *georgiella* was published in 1887. Thus, this specimen could merely be treated as a pseudotype of *georgiella*, and as such had no nomenclature value. For this reason, the present author found it reasonable to abstain from application of the name *georgiella* to his new species *subargentana*. Until the real type of *georgiella* is found, the only valid treatment of *georgiella* is that of Fernald ("1902"), who, as the first author, listed this name as a synonym of *argentana*.

The North American specimens of *argentana* do not differ from the subspecies *argentana*, widely distributed in the Palearctic region.

EANA (*ABLABIA*) *SUBARGENTANA* Obraztsov, NEW SPECIES

Figures 2, 6

Cnephasia osseana niveosana, Forbes (not Packard), "1923" [1924], *Mem. Cornell univ. agr. exp. sta.* 68: 488.

Antenna black, diffusely white scaled and indistinctly annulated. Labial palpus gray or brownish gray, on inner side and occasionally at base, cream-white. Head and thorax white or cream-white. Abdomen gray, diffusely scaled or annulated with white, occasionally yellowish caudad. Forewing entirely white or cream-white grayish, with strong silky gloss; fringes white or cream white; reverse dark gray, at costa and apex whitish or yellowish. Length of forewing, 9-14 mm. Hind wing white, or gray above and beneath; fringes white or cream-white, with grayish basal line.

Male genitalia: Valva with the costa almost straight or slightly concave; sclerotized trace of the sacculus arched, with the tip acute, directed slightly downward; cucullus rather abruptly narrowed externally.

Female genitalia: Sterigma with laterocephalic angles slightly produced and somewhat acute. Common length of the antrum and ductus bursæ about three times as long as the cervix bursæ.

TYPES: Holotype, male, and Allotype, female, 17 miles east of Mayfield, Sanpete County, Utah, 10,200 feet, August 1 and 3, 1958 (F., P., & J. RINDGE); 11 male Paratypes, and five female Paratypes, the same data but August 1-5, 1958. All types are deposited in the American Museum of Natural History.

Other specimens examined: BRITISH COLUMBIA: 17 males (genitalia of one on slide, No.374-Obr.), Wellington, July (BRYANT); deposited in the American Museum of Natural History. WASHINGTON: One male (genitalia on slide, No. 3235, prep. J. F. GATES CLARKE on Nov. 4, 1940), Slate Peak, Okanogan County, 6500-7000 feet, August 2, 1940 (J. F. GATES CLARKE); one male, Skyline Ridge, Whatcom County, August 16, 1930 (J. F. GATES CLARKE); one male (genitalia on slide, prep. A. Busck on March 2, 1930), Skyline Ridge, Mt. Baker, July 26, 1925 (J. F. GATES CLARKE); one female (genitalia on slide, No.1-Obr. 3/20 1959), Paradise Valley, Mt. Rainier, August 31, 1932 (J. F. GATES CLARKE); the above four specimens are deposited in the U. S. National Museum. One male (genitalia on slide, No.305-Obr.), Chinook Pass, August 2, 1941 (G. H. & J. L. SPERRY Collection), deposited in the American Museum of Natural History. CALIFORNIA: Four males, Lakeshore, Fresno County, 7000 feet, July 10, 1940 (F. RINDGE); Pothole Meadows, Josemite National Park, 9950 feet, July 3, 1946 (F. RINDGE); one male, Cedarville, Modoc County, July 8, 1946 (F. RINDGE); one male (genitalia on slide, No.399-Obr.), Summit, Sierra Nevada (Edwards Collection). NEW MEXICO: One male, Panchuela Ranger Station, near Cowles, July 6-9, 1957 (A. B. KLOTS); one male, 2.5 miles E. Cloudcroft, Otero County, August 7, 1947 (A. B. KLOTS); two males, near Las Conchas Camp, Jemez Mountains, July 12, 1957 (A. B. KLOTS). MONTANA: Two males, Continental divide, 6 miles N. E. Gibbons Pass, Ravalli & Beaverhead Counties, 6950 feet, August 1, 1956 (F. & P. RINDGE); one male, Cooke City, Park County, July 27, 1959 (F., P., &

B. Rindge). COLORADO: seven males, Capitol City, Hinsdale County, July 25-26, 1936; one male, Boulder (Oslar); one female (genitalia on slide, No.117-Obr.), no data (Edwards Collection); one male, Gould, Jackson County, 9000 feet, July 12, 1956 (F. & P. Rindge); one male (genitalia on slide, No.378-Obr.), Rock Creek, vicinity Colorado Springs, August 25, 1935 (A. B. Klots); one male (genitalia on slide, No.379-Obr.), Platte Canyon (Oslar). OREGON: One male, Lazy T Ranch, near Joseph, Wallowa County, July 17, 1949 (G. H. & J. L. Sperry Collection). IDAHO: One male, North Fork Camp, 9 miles N. W. Ketchum, Blaine County, 6200 feet, July 28, 1956 (F. & P. Rindge). WYOMING: 15 males (genitalia of one on slide, No.607-Obr.), Bottle Creek Camp, 7 miles N. W. Encampment, Carbon County, 8800 feet, August 8-11, 1959 (F. & P. Rindge); seven males, two females, Lower Green River Lake, Wind River Range, Sublette County, 8000 feet, July 18, 1956; August 9, 1953; August 3-9, 1959; F. & P. Rindge); three males, one female, Green River, Wind River Range, July 24 to August 7, 1935 (A. B. Klots); two males, Sacajawea Camp, 24 miles W. Big Piney, Sublette County, 8400 feet, August 14, 1953 (F. & P. Rindge); August 1, 1959 (F., P., & B. Rindge); two males, one female, Middle Piney Creek, Wyoming Range, Sublette County, 8400-8850 feet, August 12-13, 1953 (F. & P. Rindge); one male, Smith Creek-Rambler, Sierra Madre Mountains, Carbon County, 9400-9700 feet, August 10, 1959 (F., P., & B. Rindge); one male, Moose Flat Camp, 27 miles S. E. Alpine, Lincoln County, 6200 feet, July 29, 1959 (F., P., & B. Rindge); one male (genitalia on slide, No.380-Obr.), Medicine Bow Mountains, July 31, 1937 (G. H., and J. L. Sperry Collection); one male, Togwotee Pass, Teton County, August 2, 1939 (G. H. & J. L. Sperry Collection); two males, same locality but 8700-9600 feet, July 21, 1956 (F. & P. Rindge). UTAH: Three males, one female, Huntington Canyon Camp, 22 miles N. W. Huntington, Emery County, 8000 feet, August 8-9, 1958 (F., P., & J. Rindge); four males, Flat Canyon Camp, 33 miles N. W. Huntington, Sanpete County, 8800 feet, August 7-8, 1958 (F., P., & J. Rindge); three males, one female (female genitalia on slide, No.141-Obr.), Warner Ranger Station, La Sal Mountains, 9000 feet (and no altitude data), July, 1933, and July 21, 1936; seven males, one female, Loop Camp, S. W. from Grantville, Tooele County, 7400 feet, July 16-19, 1958 (F., P., & J. Rindge); three males, between Mill Fork and Desert Peak Trail, Stansbury Mountains, Tooele County, 7500-9500 feet, July 19, 1958 (F., P., & J. Rindge); six males, Wolf Creek Camp, 14 miles W. Hanna, Wasatch County, 9500 feet, August 12, 1958 (F., P., & J. Rindge); one male, 26 miles S. E. Salina, Sevier County, 10,100 feet, July 31, 1958

(F., P., & J. RINDGE); one male, Mirror Lake, Uintah Mountains, Duchesne County, July 12, 1936; one male, along road from Kamas, Summit County, to Mirror Lake, Duchesne County, 9000 feet; six males, one female (genitalia of two males on slides, Nos.376-Obr. and 377-Obr.), Provo, July 14-24, 1909 (T. SPALDING); one male, no data. NEW YORK: One male (genitalia on slide, No.375-Obr.), Big Indian Valley, Catskill Mountains, June 22, 1906 (R. F. PEARSALL).

Remarks: This species, widely distributed in North America, is very similar to *argentana*, but can be distinguished from it even without examination of the genitalia. The forewings of *subargentana* never have any bluish reflection, as is usually observed in *argentana*. In the latter species this reflection is caused by the gray color of scales of the under surface of the forewing. In *subargentana* these scales are less lustrous from the side turned to the wing membrane. A slight scraping of the upper surface of the forewing with a fine pin is adequate for making the scales of the under surface visible. In many cases this operation is unnecessary, since these scales are already seen on the places of forewings, where the white scales of the upper wing surface are rubbed out. All scratches on the upper surface of forewings look dark gray, in *argentana*, but they are yellowish and inconspicuous, in *subargentana*.

An examination of the genitalia is very helpful in separation *subargentana* from *argentana*. It is not always necessary to dissect the males for this purpose. Remowing the scales from the ventral surface of the penultimate abdominal segments with a pin and brush is usually enough for identification. The strongly sclerotized traces of the sacculi are seen well, even *in situ*. They are thick and strongly bent, in *argentana*, and narrow and slightly, gradually curved, in *subargentana*. A dissection is necessary for the study of the female genitalia. The sterigma of *subargentana* is somewhat larger than in *argentana*, and has the latero-caudal angles much shorter. The antrum and ductus bursæ are longer, in *subargentana*, but the cervix bursæ is shorter than in *argentana*.

FORBES ("1923") correctly separated the "cream white, somewhat shining" species (*i.e. subargentana*) from *argentana*, but used a wrong name, "*Cnephasia osseana niveosana*," believing that the species with "the wings less pointed than in *A. argentana*" is distributed from "Labrador to Alaska, and southward in the Rocky Mountains," and has also been found in the State of New York. It seems probable that FORBES did not compare the genuine *niveosana* from Labrador with the southern specimens which he referred to this form. In point of fact, they are completely unlike each other. The specimens from Alaska belong to *osseana*, and are also distinct from the southern *subargentana*.

Only in a few cases can *subargentana* be confused with *osseana*. The forewings in *subargentana* are less acute than in the latter species. The most typical character distinguishing these two species is in the hind wings which in *subargentana* are white or pale gray, always paler than in *osseana*. Moreover, the forewings of *subargentana* never have any, even slightest markings. On the other hand, among the *osseana* specimens there are not any with the forewings as white as in *subargentana*, except the Palearctic *Eana osseana pamira* Obraztsov. But this latter does not have to be taken into consideration since it is not present in North America. If there are some doubts about the adequacy of the external characters, the genitalia always give a good base for separation *subargentana* from *osseana* or *niveosana*.

In the male genitalia the more or less strongly curved trace of the sacculus of *subargentana* separates it well from any form of *osseana*, which have this sclerotized trace more straight, with the tip never directed downward. The sterigma of the female of *subargentana* has the laterocephalic angles more or less acute; in *osseana* they always are rounded. The antrum and ductus bursæ of *subargentana* are distinctly longer than the cervix bursæ, and broader than in *osseana*. In the latter species the antrum and ductus bursae are distinctly shorter than the cervix bursæ.

Range: As seen from the list of the examined material, *subargentana* has a wide distribution in North America. The new species will probably be found in some other states, also. At present there is no satisfactory material to maintain that the more yellowish colored specimens from British Columbia and States of Washington and New York are a constant geographic subspecies.

Eana (*Ablabia*) *osseana osseana* (Scopoli)

Figure 7

Phalæna osseana Scopoli, 1763, *Ent. Carniolica*: 238.

Phalæna (*Tortrix*) *osseana*, Villers, 1789, *Caroli Linnæi ent.* 2: 424.

Tortrix quadripunctana Haworth, 1811, *Lepid. Brit.*: 468.

Tortrix pratana Hübner, 1811-1813, *Sammlung europ. Schmett.*, *Tortrices*: pl.36, figs.227, 228. Frölich, 1828, *Enum. Tortricum Würtembergiæ*: 67. Treitschke, 1830, *Schmett. Europa* 8: 101; 1835, *Schmett. Europa* 10, pt.3: pp. 70, 248.

Eutrachia pratana, Hübner, 1822, *Syst. alphabet. Verz.*: 63.

Ablabia pratana, Hübner, 1825, *Verze. bek. Schmettlinge* [*sic*]: 383. Stephens, 1852, *List spec. British animals*, pt.10: 69. Stainton, 1859, *Manual British butt. moths* 2: 259. Wilkinson, 1859, *British Tortrices*: 257, pl.4, fig.8.

Cnephasia cantiana Curtis, 1826, *British Ent.*: explanation of pl.100.

Cnephasia quadripunctana, Curtis, 1826, *op. cit.*: explanation of pl.100. Stephens, 1829, *Syst. cat. British insects* 2: 180, no.6990.

Ablabia quadripunctana, Stephens. 1834, *Ill. British ent., Haustellata* 4: 126. Westwood & Humphreys, 1845, *British moths* 2: 140, pl.87, fig.13.

Tortrix boreana Zetterstedt, 1840, *Insecta Lapponica*: 980.

Argyroptera pratana, Duponchel, 1836, *Hist. nat. lépid.* 9: 446, pl.259, fig.8; 1846, *Cat. méthod. lépid. Europe*: 310.

Ablabia quadripunctata Westwood. 1840, *Introd. modern class. insects* 2, Synopsis genera of British insects: 108 (wrong spelling for *quadripunctana* Haworth).

Aphelia pratana, Guenée, 1845, *Ann. soc. ent. France* (sér.2) 3: 305; "1845" [1846], *Europ. Microlepid. index methodicus*: 67.

Tortrix (*Ablabia*) *pratana*, Herrich-Schäffer, 1851, *Syst. Bearb. Schmett. Europa* 4: 178.

Ablabia cantiana, Stephens, 1852, *List spec. British animals* 10: 69.

Aphelia quadripunctata, Westwood, 1852, *in* Wood, *Index ent.* ed. 2: 147, pl.33, fig.995.

Tortrix osseana, Zeller, 1855, *Stettiner ent. Zeitg.* 16: 247. *Meyrick*, 1895, *Handbook British Lepid*: 542. Fernald, "1902" [1903], *Bull. U. S. Natl. Mus.* 52: 483, no.5409 (*in part*). Kennel, 1910, *Palæark. Tortriciden*: 195, pl.10, fig.15. Benander, 1940, *Opuscula Ent.* 5: 53.

Sciaphila osseana, Lederer, 1859, *Wiener ent. Monatschr.* 3: 251. Walker, 1863, *List spec. lepid. insects*, pt.27: 224. ? Grote, 1882, *New check list North American moths*: 58, no.66.

Sciaphila (*Ablabia*) *osseana*, Heinemann, 1863, *Schmett. Deutschlands und Schweiz*, div.2, vol.1, fasc.1: 54. Wocke, 1871, *in* Staudinger & Wocke, *Cat. Lepid. europ. Faunengeb.*: 240, no.767.

Tortrix steineriana var.? *stelviana* Millière, 1874, *Icon. descr. chenilles lépid. inédits* 3: 434, pl.153, figs.11-14.

Cnephasia osseana, Rebel, 1901, *in* Staudinger & Rebel, *Cat. Lepid. palaearct. Faunengeb.* 2: 91, no.1605. Meyrick, 1912, *in* Wagner, *Lepid. cat.*, pt.10: 43; 1913, *in* Wytsman, *Genera insect.* fasc.149: 44. Barnes & McDunnough, 1917, *Check list Lepid. Boreal America*: 178, no.7401. Meyrick, 1927, *Rev. handbook British Lepid.* 513. McDunnough, 1939, *Mem. So. Calif. acad. sci.* 2: 58, no.7458. Benander, 1950, *Svensk Insektfauna*, pt.10: 47, fig.6*v*.

Ablabia osseana, Fernald, 1908, *Genera Tortricidæ*: 12, 53. Busck, 1931, *Bull. Brooklyn ent. soc.* 26: 210, pl.11, fig.7.

Cnephasia osseana ab. *biformana* Hauder, 1913, *Jahresber. Mus. Francisco-Carolinum* 71, *Beiträge Landeskunde*, fasc.65: 95; 1919, *Zeitschr. Oesterreich. ent. Ver.* 4: 59.

Nephodesme osseana, Pierce & Metcalfe, 1922, *Genitalia group Tortricidae British Islands*: 13, pl.6.

Cnephasia (*Ablabia*) *osseana*, Réal, 1953, *Bull. mens. soc. linnéenne Lyon* 22: 52. Razowski, 1957, *Acta zool. Cracoviensia* 1: 122, pl.15, fig.1; pl.20, fig.3; pl.23, figs.7, 8.

Cnephasia (*Ablabia*) *osseana* "sous-espèce" *biformana* & "race" *pratana*, Réal, 1953, *Bull. mens. soc. linnéenne Lyon* 22: 52.

Cnephasia (*Ablabia*) *osseana* "race" *borreoni* & "forme ind."*pseudolongana* Réal, 1953, *ibid.* 22: 52.

Eana (*Ablabia*) *osseana*, Obraztsov, 1955, *Tijdschr. ent.*, 98: 173; 1956, *ibid.* 99: 120. Razowski, 1959, *Acta zool. Cracoviensia* 4: 275, pl.26, figs.77, 78; pl.47, fig.222; pl.62, fig.292. Hannemann, 1961, *Kleinschmetterlinge*, I. *Die Wickler*, in *Tierw. Deutschlands*, pt.48: 44, fig.70, pl.5, fig.9.

Eana osseana, Bradley & Martin, 1956, *Ent. gaz.* 7: 154, pl.7.

Ablabia osseana form *impunctana* Strand, 1901, *Nyt Mag. Naturv.* 39: 67.

Tortrix osseana form *pallida* Müller-Rutz, 1920, *Mitt. Ent. Zürich*, 5: 338, pl.2, fig.3; 1922, *Mitt. schweiz. ent. Gesell.* 13: 224.

form *impunctana* Strand

Cnephasia (*Ablabia*) *osseana* (in part), Réal, 1953, *Bull. mens. soc. linnéenne Lyon*, 22: 52.

Cnephasia (*Ablabia*) *osseana* "race" *alpicola* Réal, 1953, *ibid.* 22: 52, 98.

Cnephasia (*Ablabia*) *osseana* "forme ind." *solfatarana* Réal, 1953, *ibid.* 22: 52.

A. [*blabia*] *osseana* "var." *alpicolana* Réal, 1953, *ibid.* 22: 61 (misspelling for *alpicola* Réal).

Eana (*Ablabia*) *osseana* "ab." *impunctana*, Obraztsov, 1956, *Tijdschr. ent.* 99: 120. Razowski, 1959, *Acta zool. Cracoviensia* 4: 275.

TYPES: The types of *osseana* ("Carniolia") and *pratana* ("Europe") are lost. Those of *quadripunctana* ("County of Norfolk, England") and *cantiana* ("County of Kent, England") probably are deposited in the British Museum (Natural History), but the present author could not locate them. The type of *boreana* ("North Lapland") is in the Zetterstedt Collection (Benander, 1940). The location of the types of *stelviana* ("Stelvio"), *biformana* ("Oberösterreich"), *impunctana* ("Tysfjorden, Norway"), and *pallida* ("Lago di Naret, Switzerland") is unknown. The types of *borreoni* ("Vallée de Borréon, France"), *pseudolongana* ("Pralognan, Savoie"), *alpicola* ("Les Etages-en-Oisans, France"), and *solfatarana* ("La Schlucht, Vosges") are in the Paris National Museum and in the Réal Collection.

Specimens examined: Many specimens from England, France, Germany, and other European countries, deposited in the American Museum of Natural History, United States National Museum, British Museum (Natural History), and Zoological Collection of the Bavarian State. ALASKA: Two males (genitalia on slides, prepared by A. Busck on March 27, 1920, and October 1, 1922), Kukak Bay, July 4, 1899 (T. Kincaid, Harriman Expedition); one male, Afognak, August 4, 1940 (E. C. Johnston); one female (genitalia on slide, prepared by A. Busck on January 7, 1928), Nunivak Island, August, 1927 (Stewart & Collins); the above four specimens are deposited in the United States National Museum. ALBERTA: One female, Lake Louise, August 18 (Kearfott Collection); one female (genitalia on slide, No.469-Obr.), Mt. Piran, August 17 (Kearfott Collection); the above two specimens are deposited in the American Museum of Natural History.

Male genitalia: Valva with the costa straight or slightly undulate; the tip of the sclerotized trace of the sacculus directed externad, not turning downward; cucullus gradually narrowed externad.

Female genitalia: Sterigma with laterocephalic angles simple, Common length of the antrum and ductus bursæ almost equal that of the cervix bursæ, or somewhat shorter.

Remarks: The North American specimens of the subspecies *osseana* are rather similar to those from the Palearctic region, although the forewing markings on a pale ochreous or slightly grayish suffused ground are less developed than have usually been observed in the Central European moths of this subspecies. In some specimens the forewings are unicolorous, without any markings (form *impunctana* Strand).

Range: This subspecies is widely distributed in the Palearctic region. In North America it is known only from Alaska and Alberta. It seems very probable that it will be found also in the intermediate territories.

Eana (*Ablabia*) *osseana niveosana* (Packard)

Figure 3

Sciaphila niveosana Packard, 1866, *Proc. Boston soc. nat. hist.* 11: 55. Walsingham, 1879, *Ill. typical spec. Lepid. Het.* 4: 77. Fernald, 1882, *Trans. Amer. ent. soc.* 10: 16. Grote, 1882, *New check list North Amer. moths*: 58, no.67. Packard, 1888, *Canad. ent.* 20: 145.

Tortrix pratana, Christoph (not Hübner), 1858, *Stettiner ent. Zeitg.* 19: 113. Möschler, 1860, *Wiener ent. Monatschr.* 4: 333.

Ablabia pratana, Möschler (not Hübner), 1860, *ibid.* 4: 380.

Sciaphila (*Ablabia*) *osseana* (in part), Wocke, 1871, *in* Staudinger & Wocke, *Cat. Lepid. europ. Faunengebiets*: 240, no.767.

Sciaphila osseana (in part), Fernald, 1882, *Trans. Amer. ent. soc.* 10: 16. Packard, 1888, *Canad. ent.* 20: 145.

Sciaphila osseana "v." *niveosana,* Sommer, 1898, *Deutsche ent. Zeitschr. Iris* 10: 400.

Cnephasia osseana "v." *niveosana,* Rebel, 1901, *in* Staudinger & Rebel, *Cat. Lepid. palaearct. Faunengebietes* 2: 91, no.1605*a*. McDunnough, 1939, *Mem. so. California acad. sci.* 2: 58, no.7458*a*.

Tortrix niveosana, Ferald, "1902" [1903], *Bull. U. S. nat. mus.* 52: 483, no.5410.

Tortrix osseana (in part), Fernald, "1902" [1903], *ibid.* 52: 483, no.5409.

Tortrix osseana "var." *niveosana,* Kennel, 1910, *Palaeark. Tortriciden*: 196, pl.10, fig.16.

Cnephasia osseana (in part), Meyrick, 1912, *in* Wagner, *Lepid. cat.,* pt.10: 43; 1913, *in* Wytsman, *Genera insect.,* fasc.149: 44. Barnes & McDunnough, 1917, *Check list Lepid. Boreal America*: 178, no.7401.

Cnephasia (*Tortrix*) *osseana* "var." *niveosana,* Caradja, 1916, *Deutsche ent. Zeitschr. Iris* 30: 48.

Eana (*Ablabia*) *osseana* "ssp." *niveosana,* Obraztsov, 1956, *Tijdschr. ent.* 99: 120.

TYPES: Lectotype of *niveosana,* male, Labrador; deposited in the United States National Museum. Two male paratypes, Okak, Labrador; three male paratypes, Hopedale, Labrador; one male paratype (genitalia in vial); the above paratypes are deposited in the Museum of Comparative Zoology.

Other specimens examined: Two males and one female (genitalia on slides, prepared by A. BUSCK on July 12, 15, and 16, 1926), Nain, Labrador (P. HETTACH); one male, Ungava Bay, Quebec (L. M.

TURNER); the above three specimens are deposited in the United States National Museum. One male (genitalia on slide, No.381-Obr.), Codroy, Newfoundland, July-August, 1905 (L. P. GRATACAP), deposited in the American Museum of Natural History.

Male and female genitalia: As in the subspecies *osseana.*

Remarks: This subspecies is easily recognizable by whitish gray forewings, usually with gray markings on them. A rather large, gray spot at the end of the discal cell, some small spots or short longitudinal lines at termen, and some interrupted, transverse, fine lines, or rows of little dots across the forewing, especially distinct in the subterminal area, represent the only pattern of the forewings if it is developed. Some specimens lack these markings completely, and they might be identified as form *impunctana* Strand (see above, under the subspecies *osseana*).

Range: This subspecies is rather local. In North America it is known only from Labrador, Newfoundland, and northern part of Quebec. The European record of *niveosana* in Lapland should be confirmed.

EANA ABLABIA IDAHOENSIS Obraztsov, NEW SPECIES

Figure 4

Male: Antenna black, on the outside finely, pale yellow annulated. Labial palpus brown, on the inner side yellowish white. Head pale yellow. Thorax and abdomen yellowish gray. Forewing with a ground layer of gray scales, covered more or less completely by a layer of longer, pale yellow scales; some obliterate, round, pale brown spots at the end of discal cell; two or three transverse rows of similar spots in external area of the forewing, and some scattered spots in other areas; fringes pale yellow; reverse entirely dark brownish gray, only the fringes as on the upper side. Length of forewing, 11 mm. Hind wing dark gray; fringes pale yellow, grayish apical, and with a grayish basal line.

Female: Unknown.

Male genitalia: Valva with costa distinctly incurved; sclerotized trace of sacculus strongly arched, with acute tip directed downward; cucullus directed somewhat upward.

TYPES: Holotype, male (genitalia on slide, No. 465-Obr.), Alturas Lake, Blaine County, Idaho, 7000 feet, July 26, 1956 (F. & P. RINDGE); two male paratypes, the same data but July 24 and 26. All types are deposited in the American Museum of Natural History.

Remarks: This new species externally reminds one of some unicolorous, gray specimens of *osseana,* but differs from them in having darker hind wings. The male genitalia are somewhat similar to those of *subargentana,* but the sclerotized trace of the sacculus is broader and much stronger arched, distinctly and abruptly narrowed apicad. The forewings are more acute than in *subargentana.*

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R E V I E W

PIERIDÆ – PAPILIONIDÆ. By Mieczyslaw Krzywicky. 1962. 45 pp., 59 figs. Published by the Polish Entomological Society in the series *Klucze do Oznaczania Owadow Polski* (Keys for the Identification of Polish Insects), numbers 65-66, Warszawa 1962. [Available from "Ars Polona", Kracowskie Przedmiescie 7, Warszawa, Poland; price 10.- zl.] [In Polish.]

A further part of the Polish "Keys" contains a survey of these two families of butterflies. In the introduction the author gives a short report about each of these families. The keys for the identification go into details and inform us also about the life-history, distribution and variability. All species are figured, and for some of the similar species (*e. g., Colias hyale* L. and *C. australis* Vty.) the genitalia and scales are figured also. In Poland are recorded 13 species of Pieridæ and 4 of Papilionidæ.

For the list of all preceding parts on Lepidoptera of the "Keys" for the identification of Polish Insects see in the *Journal Lepid. Soc.* 15: p.132; 1962.

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SOME NOTES ON *CALLOPHRYS* (*MITOURA*) *JOHNSONI* (LYCÆNIDÆ) IN CALIFORNIA

by PAUL A. OPLER

Since *Callophrys* (*Mitoura*) *johnsoni* (Skinner) has been a rather scarce insect in collections until recent years, and because its exact habitat has not been described in the literature, I believe that the following observations will be not only of interest to all collectors but of great aid to western collectors in obtaining this species.

Some years ago ROBERT G. WIND of Monterey, California, took about ten specimens of *Callophrys johnsoni* in the vicinity of Gold Lake Lodge, Sierra County, California. He relayed this information in 1962. During 1960 and 1961, I collected nineteen specimens of *C. johnsoni* at three separate localities in Sierra County; when these collections were made I was able to make observations which should increase the available knowledge of this species.

On June 13, 1960, a single male was taken 1½ miles east of Bassets, Sierra County, California. The insect was visiting *Ceanothus cordulatus* Kell. Several specimens of *Callophrys* (*Mitoura*) *nelsoni* (Boisduval) were collected at this time visiting *Ceanothus cordulatus* and *Calyptridium umbellatum* (Torr.). On June 17, 1961 at the above locality, two fresh females of *C. johnsoni* were collected. The first specimen was caught while visiting the flowers of *Calyptridium umbellatum;* the second specimen was observed and taken while it was flying.

On July 1, 1961 fifteen males and one female of *C. johnsoni* were collected in the vicinity of Gold Lake Lodge, Sierra County, near the Plumas County line. The specimens were fairly worn and were collected mainly on *Ceanothus cordulatus.* Two very fresh examples of *Callophrys* (*Mitoura*) *spinetorum* (*Hewitson*) were collected at this time also visiting *C. cordulatus.* No *C. nelsoni* were seen at this locality. Since *C. spinetorum* is known to feed on several species of the genus *Arceuthobium* as recorded by COMSTOCK and DAMMERS (1938), GARTH (1950), and REMINGTON (1958), and since the original description of *C. johnsoni* by SKINNER (1903) lists the foodplant as being a mistletoe, a search of the area for a possible foodplant was conducted with the above facts in mind. It was found that *Arceuthobium campylopodum* Engelm. was present in fair abundance on *Abies magnifica* Murr.

The Gold Lake Lodge locality is the same one where ROBERT WIND had taken his series several years before. The specimen used as the

model for Mrs. EHRLICH's drawing of *Callophrys johnsoni* possibly came from the above collection (Ehrlich 1961). Also on July 1, 1961 one male and one female of *C. johnsoni,* both worn, were collected on *C. cordulatus* at the summit of Yuba Pass, Sierra County.

At all three localities stands of mature *Abies magnifica* were present. The *C. johnsoni* were always found in areas of partial shade along the edges of the above stands. Most specimens were collected while visiting *Ceanothus cordulatus,* probably because this plant grows in partial shade and is in bloom at the time when *C. johnsoni* is in flight. It seems probable that *C. johnsoni* is restricted to some species of *Arceuthobium* in the larval stage, and the adult is therefore not to be expected far from these plants. On the other hand, it would be surprising if the distribution of the butterfly was found to be limited only by the distribution of the foodplant. Doubtless, factors which are now unknown are limiting the occurrence of this insect. In the future *Callophrys johnsoni* should be collected in California more frequently since its ecological requirements are better known.

SUMMARY

1. Collection data: 1 ♂, 1½ mi. E. Bassets, 5460′, Sierra Co., Calif., VI-13-60 (OPLER); 2 ♀ ♀, same locality VI-17-61 (OPLER); 15 ♂ ♂ 1 ♀, Gold Lake Lodge, 6560′, Sierra Co., Calif., VII-1-61 (OPLER); 1 ♂ 1 ♀, summit Yuba Pass, 6708′, Sierra Co., Calif., VII-1-61 (OPLER).

2. The foodplant of *C. johnsoni* is probably *Arceuthobium campylopodum.*

3. *C. johnsoni* and *C. spinetorum* were found together, possibly for the first time. No published record of this sympatry has been seen by me.

4. *C. johnsoni* is a Canadian Zone forest species with an early flight period.

ACKNOWLEDGEMENTS

I would like to thank ROBERT G. WIND for the information which made these collections possible, Dr. C. D. MACNEILL of the California Academy of Sciences who read this paper and gave me invaluable aid, and J. T. HOWELL of the California Academy of Sciences who kindly determined the *Arceuthobium.*

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NOTES ON *EURISTRYMON ONTARIO ONTARIO* AND *SATYRIUM CARYÆVORUS* (LYCÆNIDÆ)

by GORDON B. SMALL, JR.

The recent *Journal* article by Dr. SMITH (1960) on the occurrence of *Erora læta* Edw. in New Hampshire has prompted me to make a few comments on two other hairstreaks which have in the past been considered rare and local in the Northeast. I refer to *Euristrymon ontario ontario* Edw. and *Satyrium caryævorus* McDunnough.

Virtually all records of *E. ontario* north of Virginia seem to have been based on singletons. A. H. CLARK (1934) called it "one of the rarest and least known of our eastern butterflies". More recently, EHRLICH and EHRLICH (1961) have described it as "extremely rare in the Northeast." The only records for New England prior to 1961 of which I am aware are single specimens from Amherst and Waltham, Mass., and Plantsville, Conn., as given by SCUDDER (1889). It is therefore of interest to report that this elusive species was taken on July 18, 1961 in two separate localities in Rhode Island. More specifically, on a trip in company with Mrs. E. A. CREER to the wildlife reservation in the Great Swamp area in Kingston, one worn female was taken along a wood road. At 5 P.M. on the way back to Providence, a stop was made at Exeter, R. I., where three more females were found, two worn and one fresh. This locality is an old field with scattered shrubs and Red Cedars (*Juniperus*) bordered by a woodland, and is an especially rich one for Theclines. Despite the late hour, six additional species of hairstreaks were taken at the same time. These are *Satyrium liparops* B. & L., *caryævorus* McD., *calanus falacer* Godart, *edwardsii* Saunders, *Strymon melinus* Hübner and *Chrysophanus titus* Hübner. In the spring, *Callophrys gryneus* Hübner, *irus* Godart, and *augustinus* Kirby are also to be found here. It is unfortunate that these localities were discovered at a time when *ontario* was definitely on the wane. I suspect that if they had been visited a week or so earlier, a fair series would have been obtained. It will be most interesting to see whether this species turns up again next year.

As for *Satyrium caryævorus,* prior to 1959 this species seems to have been rare and local virtually everywhere. It was usually found in company with *S. calanus falacer,* with the latter species dominant. However, in the last few years, *caryævorus* has suddenly become one of the commonest hairstreaks in southern Connecticut and New York and northern New

Jersey, at least locally so. I first took it in Riverside, Conn., in 1959, where it was abundant, and the determination was confirmed by Dr. A. B. KLOTS. He had found it simultaneously nearby in Greenwich, and described the early stages (1960). Since that time I have found it in a number of additional localities, and with the sole exception of the Exeter, R. I. locality, it was by far the dominant *Satyrium* species wherever it occurred. Furthermore, the species has in the past two years been taken far to the south of the range as known prior to that time (see Klots, 1951). KLOTS (1960) reports it from Kentucky, and I have seen a specimen taken by LUCIEN HARRIS, JR. in Union County, Georgia. That the species has undergone a tremendous population explosion seems evident. This poses many questions, and again it will be interesting to see whether the population level changes significantly in the next few years.

At any rate, it would seem safe to say that 1961 was a banner year for Theclini in the Northeast.

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THE OCCURRENCE OF *SATYRIUM KINGI* (LYCÆNIDÆ) IN VIRGINIA

by CHARLES V. COVELL, JR.

Noting some unusual variations from the normal characters of *Satyrium calanus falacer* (Godart) in some specimens determined as such in his collection, the author took the problem to W. D. FIELD at the U. S. National Museum in September, 1961. The specimens were compared with *S. kingi* Klots & Clench taken by Mr. FIELD that summer in Georgia, and one male was found to be *kingi*. The genitalia were compared with those of the Georgia specimens and with the figure in the original description of the species (Klots & Clench, 1952). Later a female from the same locality as the male was determined by the author as being *kingi*, also on the basis of comparing genitalia with the figures in the original description. Other specimens in the group studied were found to be *S. edwardsii* Saunders and *Euristrymon ontario* Edwards. The *edwardsii* were taken in Middlesex and Gloucester Counties, Virginia, and the *ontario* in Middlesex County. The *kingi*, on the other hand, were taken at one confined locality in Princess Anne County, Virginia, near the Norfolk Airport.

There were seven specimens of *kingi* taken at this locality on 11 June 1958. All were easy to catch, as they flew about several large shrubs or small trees in a partial clearing in a small hardwood forest near a field. All were found in an area about one quarter of an acre square. They could be seen flitting about in the sun's rays which penetrated the overstory, and were captured as they came to rest on the upper surfaces of broad leaves about shoulder high off the ground. Two of the specimens taken were females; all were fresh. Although not all specimens seen were captured, they did not appear in any great numbers. The author did not return to the location until the 26th; at that time (a real hot spell had set in) no specimens were seen.

Ecological data recorded in the original description (Klots & Clench, 1952) did not intimate that the species is difficult to net. Specimens taken in Georgia were caught on blossoms of *Castanea* (Chinquapin) along the "partly cleared edge of a heavily wooded area bordering a swampy creek. . . . " Mr. FIELD stated that his *kingi* were extremely difficult to capture, as they frequented the upper branches of a single tree in a forest. *S. kingi* is noted as "local, rare, and difficult to capture;" by H. K. CLENCH in Ehrlich & Ehrlich (1961). As to the range up to now,

CLENCH states as follows:

> "So far found only in coastal Georgia and in upland areas of South Carolina, Georgia, Alabama and Mississippi."

Students of Lycænidæ will not be surprised to hear of this extension of range, for Hairstreaks (especially woodland species) are often missed by even the most experienced collectors because of the insects' small size, rapid flight and the darkness of the forest; and also because many of these butterflies live in colonies that are very scattered and restricted in size. With the possibility of discovering a new range extension for a species of Hairstreak as great as it is, collectors should force themselves to investigate woodland areas as carefully as possible, although it is often a tedious and fruitless task; a thrilling discovery may reward their perseverence.

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FOODPLANTS OF *PAPILIO PALAMEDES* IN GEORGIA

For several years I have been trying to rear *Papilio palamedes*. KLOTS, in his *Field Guide,* states the foods as *Persea borbonia, Magnolia glauca* (now *virginiana*), and *Sassafras albidum*. I tried *Sassafras* and *Magnolia* but without results – the females refused to oviposit. After a visit to the Georgia coast where I found *palamedes* abundant, I decided to try again. This time I used *Persea* which was very fresh. About 5000 eggs were secured. Since *Persea* is in poor condition when *palamedes* is common in central Georgia, I decided to try the larvæ on fresh *Magnolia* and tender *Sassafras*. Only the *Sassafras* was accepted. I then began to try other plants related to *Persea* and *Sassafras* and found the following to be also acceptable: avocado, *Glabraria æstivalis, Nectandra* sp. and *Misanteca* sp. It appears that *palamedes* feeds only on Lauraceæ and that the females in a certain area are more addicted to one foodplant than the other; the larvæ seem to be less sensitive. This is the opposite of *glaucus* which oviposits on peach but whose larvæ will not accept it.

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NOTES ON *SATYRIUM ACADICA* AND OTHER UNUSUAL HAIRSTREAK RECORDS (LYCÆNIDÆ) IN SOUTHEASTERN PENNSYLVANIA

During the summer of 1961 I had the unexpected pleasure of discovering a colony of *Satyrium acadica* (Edwards) in Cheltenham Township, just north of Philadelphia, Pa. Shortly afterwards information was communicated to me of a similar discovery along the Wissahickon Creek, about eight miles to the southwest of the aforementioned locality.

S. *acadica* is a northern species and its occurrence this far south as a breeding resident is rather exceptional. Mr. GEORGE EHLE mentions that he had not heard of it south of the Pocono Mountains in Pennsylvania. This may be a new southern record for *acadica* as a breeding resident.

Records are from July 4-11. The species is not numerous. I took only one but saw several (5 or 6) more. My specimen is a very large female, expanding 33.4 mm. A male caught along the Wissahickon Creek measured 27.5 mm. These dates are somewhat after the common S. *falacer* and *edwardsii* hit their peak. Both localities are damp and the butterfly seems to be associated with the willow *Salix sericea*. It visits blossoms of Milkweed (*Asclepias syriaca*) freely but does not seem to wander far from the willows, and is quite wary.

Several good Hairstreak records for Philadelphia are based on strays of southern species. On Sept. 10, 1960, I had the fantastic luck to catch one each of *Eupsyche m-album* (Boisduval & LeConte) and *Calycopis cecrops* within one hour's time. The *cecrops* seemed fresh but the *m-album* was very worn. Another good species, which is common in a few spots mostly west of the city, is *Satyrium titus*.

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ADDITIONAL RECORDS OF *SATYRIUM BEHRII* (LYCÆNIDÆ) FROM OREGON

The remark in Ehrlich & Ehrlich, *How to know the butterflies* (p.192; 1961), by CLENCH, that *Satyrium behrii* was not recorded from several expected states, has resulted in the publication of records from Nevada by PHILIP (*Journ. lepid. soc.* 15: 56; 1961) and from Oregon by CLENCH (*ibid.* 16: 44; 1962).

Two additional Oregon specimens are in the collection of TILDEN. One is labelled incompletely, "Metolius River, Ore., VII.3.40", without notation

of collector; the source of this specimen is not known. The second is labelled, "Spring Creek, Baker Co., Ore., V.2.54, James Baker, Collector."

The wide difference in dates here indicates either extreme difference in climate in the two localities, or a wider range of flight dates than is usual in California.

In the *Artemisia tridentata* (Sage Brush Scrub) habitat of eastern California, the distribution of *Satyrium behrii* is reasonably continuous, and there seems no reason why it should not be so in the proper habitat wherever it occurs. The paucity of records from certain states certainly must be due to lack of collecting in such areas and to incomplete reporting of such collecting as has been done. Sage Brush is not an attractive habitat to many collectors. Moreover, *S. behrii* tends to "sit tight" rather than to fly freely; and being unusually inconspicuous at rest, it is easily overlooked.

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EVENING MATING IN *HYPAUROTIS CRYSALUS* (LYCÆNIDÆ) IN COLORADO

While helping with a chipmunk-trapping expedition in Mesa Verde National Park at 7:00 pm MST on 11 Aug. 1962, I was surprised to notice a number of large hairstreaks flying around the tops of the oak bushes. The insects were very active, although the little ravine was in the deep shadow of the large hill to the west. Their flight contained at least three distinguishable patterns: erratic flight from branch to branch; circling of branch tips; and close chasing usually restricted to a small space around the branch tips. The chasing was sometimes terminated when two individuals alighted together but I was unable to observe their subsequent behavior. I had a seven-foot net along and in the next 40 minutes collected ten specimens of *crysalus*. Among these were two mating pairs. The butterflies remained active until they could barely be seen.

The location was the turnoff about two hundred yards below the Montezuma Valley Overlook, Mesa Verde Nat. Park, Montezuma Co., Colorado.

I have since found out that evening mating by *crysalus* is not unique among North American hairstreaks; Dr. C. L. Remington tells me that he has observed it in *Satyrium acadica* in Connecticut.

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ESPECIALLY FOR FIELD COLLECTORS

(Under the supervision of FRED T. THORNE, 1360 Merritt Dr., El Cajon, Calif., U.S.A.)

COLLECTING *EURISTRYMON POLINGI* (LYCÆNIDÆ) IN TEXAS

by W. J. REINTHAL and ROY O. KENDALL

The purpose of this article is to relate some significant observations by the authors on their first encounter with *Euristrymon* (="*Strymon*") *polingi* Barnes & Benjamin.

It was about 6:30 Sunday morning, 5 June 1960, when Dr. W. J. REINTHAL arrived at San Antonio, Texas, from Knoxville, Tennessee, to join ROY O. and Mrs. CONWAY A. KENDALL for a few days of collecting in far west Texas. The group got off to a good start as the breakfast guests of Mr. and Mrs. ROY W. QUILLIN. Mrs. (ELLEN SCHULZ) QUILLIN is a noted author, lecturer, and Director Emeritus of the Witte Memorial Museum, and her botanical advice has helped us before, with Lepidoptera life history studies.

During the ten days that followed we collected from Laredo to El Paso, following more or less the Rio Grande River. We parted company on the evening of 15 June at El Paso. Dr. REINTHAL went on by train to Tucson, Arizona, to search for *Asterocampa* in Madera Canyon. The KENDALLS headed back to San Antonio collecting along the way.

It was unusually dry in most of the area collected. Early May rains had not come to the Davis Mountains area where we spent seven full days. Some widely scattered thunder-showers did occur, however, during our stay there. These rains washed out roads in Madero Canyon, Jeff Davis County, where we had expected to collect. Except in Big Aguja Canyon and low places near streams or dry creek beds the vegetation was practically dormant. General collecting was fairly good not withstanding the generally dry period.

One of the highlights of the trip occurred about mid-day on 12 June. As we rounded a curve on Scenic Loop (Texas Highway 166) about 36 miles from Fort Davis we decided to stop, get a drink of water, and look around a few minutes before proceeding on in search of more promising habitates. Elevation at this spot was 6,500 feet. It is located in H. O. Canyon between Bear Mountain, 5,446 feet on the west and Sawtooth Mountain 7,718 feet on the east. Dr. REINTHAL and Mrs. KENDALL each took a side of the road and started collecting down the mountain. ROY

KENDALL took the high road, staying near the automobile and water jug. The movement of an insect in a Catsclaw bush, *Acacia greggii* A. Gray, *about* 40 *feet away caught his attention.* As he approached the flowering shrub, the lepidopteron moved deep into the foliage, where it fed on the blossoms. After a bit of impatient waiting, the insect came to the surface and was promptly taken. After a quick examination in the killing jar, it was announced, somewhat boisterously, that *"Strymon" polingi* had been taken. The other two members hurriedly retraced their steps to have a look at the prize. This was the first time any one of the group had seen *E. polingi,* and while there was some chance that our determination was incorrect, we launched an intensive search for other specimens. Now that we knew where to look, the insect was found in good numbers. A major problem was keeping our nets free of the Catsclaw. Two hours later, nets ripped and torn, we returned to the tourist court in Alpine.

While the authors inventoried their catch, made field notes, and cared for livestock, Mrs. KENDALL mended nets. At eleven o'clock she was still finding holes. We would strongly recommend a couple of extra nets for those who would collect in the Catsclaw. The inventory disclosed that 28 *E. polingi* had been taken by the KENDALLS and 17 by Dr. REINTHAL. This same evening H. A. FREEMAN joined the party and confirmed our determination. The four of us returned the following morning to the "spot" and found *E. polingi* still flying but in fewer numbers than the previous day. The general condition of these specimens was good to excellent.

On the first day, it was observed that when disturbed this insect would often alight on *Quercus grisea* Liebm., growing nearby. It was then noted that other like insects were flying and courting about these Oaks. One of us (WJR) had placed four females in two screened cages on both *Q. grisea* and *Q. emoryi* fresh twigs, placed in water, but no eggs were laid on the leaves or branches (no rough bark was placed in the cages) in the following four days; the females were fed every day but they died on the fifth day. Four females were kept alive by the other of us (ROK) in the hope that eggs could be obtained. A few short pieces of *Q. grisea* branches having rough bark, together with the females, were placed in a cardboard container covered with a piece of window screen. Cotton soaked in sugared water was placed on top of the screen for feeding. After the return home and as the pieces of Oak were about to be discarded, it was discovered that a few eggs had been carefully tucked into the crevices of the bark. A separate paper will be prepared on the immatures of *E. polingi* when more information is available. At the time of this writing, December 1961, the eggs had not hatched.

Other Lepidoptera flying at this location included: *Euptychia rubricata* Edwards, *E. dorothea* Nabokov, *Callophrys xami* Reakirt, *Atlides halesus* Cramer, *Strymon melinus* Hübner, *Leptotes marinus* Reakirt, *Hemiargus isola* Reakirt, *Papilio p. asterius* Cramer, *Nathalis iole* Bdv., *Pyrgus communis* Grote, *Erynnis funeralis* Scudder & Burgess, *Oarisma edwardsii* Barnes, *Hesperia viridis* Edwards, and *Atalopedes campestris* Boisduval.

Vegetation at this elevation includes a number of different grasses, herbaceous plants, shrubs and trees. Most conspicuous are: *Pinus cembroides* Zucc., *Juniperus deppeana* Steud., *Quercus grisea* Liebm., *Q. emoryi* Torr., *Acacia greggii* Gray, *Fouquieria splendens* Engelm., *Opuntia imbricata* (Haworth) DC., *Opuntia engelmannii* Salm-Dyck, and *Chilopsis linearis* (Cav.) Sweet.

We would like to add the following remarks for general information. As to exact systematic value and geographic distribution of *polingi*, it is felt that these are not yet exactly known and understood. Clench places *polingi, favonius,* and *ontario* (with *autolycus* as a subspecies) in a separate genus *Euristrymon* to which also the palearctic *pruni* belongs. In a letter to one of the present authors he explains that in his opinion *polingi* is a good species, apparently very closely related to *ontario, autolycus,* and *favonius*. The food plants of all these are chiefly the oaks, and the three last forms probably should be considered as subspecies.

However, it is not known that *autolycus* occurs in the Davis Mts., which are inhabited by *polingi*. Should *autolycus* and *polingi* occur together, they certainly should be considered as two different species. Should they not occur in the same area, and *polingi* replaces *autolycus* in western Texas, a possibility exists that *polingi* after all is no more than a subspecies of *autolycus*.

E. polingi so far is known only from the Davis Mts. area. According to H. A. Freeman it first was found around a ranch north of Alpine. It has been collected by Freeman in June as fairly common, flying around the oaks (*Quercus grisea* and *Q. emoryi*) on top of Mt. Locke in the Davis Mts. Thus the locality described in this article proves that the species may be rather widely, but locally, distributed in the Davis Mts. area. Further investigation may even show a wider occurrence in western Texas.

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RECENT LITERATURE ON LEPIDOPTERA

(Under the supervision of PETER F. BELLINGER)

Under this heading are included abstracts of papers and books of interest to lepidopterists. The world's literature is searched systematically, and it is intended that every work on Lepidoptera published after 1946 will be noticed here; omissions of papers more than 3 or 4 years old should be called to Dr. BELLINGER's attention. New genera and higher categories are shown in CAPITALS, new species and subspecies are noted, with type localities if given in print.

B. SYSTEMATICS AND NOMENCLATURE

Razowski, Josef, "Neue und wenig bekannte paläarktische Wickler-Arten (Lepidoptera, Tortricidæ)" [in German]. *Zeitschr. wiener ent. Ges.,* vol.44: pp.81-87, 2 pls., 8 figs. 1959. Describes as new: *Cnephasia divisana* (Neapolis, Crete), *C. pumicana hagiosana* (Hagios Athanasios, Cyprus), *C. zernyi* (Tachdirt, 2200-2700 m., High Atlas, Morocco); *Eana kuldjaensis* (Kuldza, E. Thian), *E. schoenmanni* (Tachdirt, 2200-2900 m., High Atlas, Morocco); *Acleris boscanoides* (Stari Dojran, Macedonia). Some new synonymy and generic placements. Descriptive & distributional notes on other spp. of *Cnephasia.* [P. B.]

Razowski, Jósef, "Remarks on the family Carposinidæ" [in Polish]. *Bull. ent. Pologne,* vol.29: pp.163-166, 7 figs. 1959. Both Central European spp. (*Carposina scirrhosella* & *C. berberidella*) are described & genitalia figured. [J. M.]

Razowski, Josef, "Some remarks on Phaloniidæ" [in English; Polish summary]. *Bull. ent. Pologne,* vol.29: pp.437-446, 19 figs. 1959. Describes as new *COCHYLIMORPHA* (type *Cochylis favillana* Staudinger). [J. M.]

Razowski, Josef, "Remarks on the types of some African Tortricidæ" [in English; Polish summary]. *Bull. ent. Pologne,* vol.30: pp.169-172, 4 figs. 1960. Some spp. described by Meyrick are discussed and genitalia are figured. Without new taxa. [J. M.]

Rebillard, P. (with descriptions of new taxa by Lathy and Le Cerf), "Contribution à la connoissance des Riodinidæ sud-americains" [in French]. *Mém. Mus. national Hist. nat.,* n.s., *A, Zool.,* vol.15: pp.135-216, 10 pls. (4 in color), 9 figs. 1958. Contribution to the knowledge of the South American Riodinidæ. Results of the studies made before and during the war by Lathy and Le Cerf on the beautiful and rich collection of Mme. Fournier de Horrack. The first part is devoted to the story of this important collection. Describes as new: *Euselasia psammathe hypocala* Le Cerf (SE Colombia), *E. dione* Lathy (Colombia, Rio Putumayo), *E. gelisæ* Le Cerf (Amazons, Rio Curva), *E. pellos lineata* Rebillard (Amazons, Rio Maues), *E. orion* Le Cerf (Colombia, Rio Micay); *Mesosemia phelina calliops* Le Cerf (French Guiana), *M. p. simulans* Le Cerf (Equator, Rio Napo), *M. mayi* Lathy (Brazil, Rio de Janeiro); *Alesa fournieræ* Lathy (Amazone, Uypiranga); *Themone inornata* Lathy (Amazone, Rio Tapajoz, Barreiras); *Ancyluris gelisæ* Lathy (Amazone, Téffé); *Zelotæa lya* Lathy (Amazone); *Comphotis delicia* Lathy (Amazone, Rio Umary); *Symmacha nemesis* Le Cerf (Brazil, Santa Catharina); *Argyrogrammana cæsarion* Lathy (Brazil, Gavea); *Antheros gentilis* Rebillard (Peru, Pichis); *Charis chelonis virido* Lathy (Bolivia, Rio Songo); *Charis chelonis virido* Lathy (Bolivia, Rio Songo); *Emesis adelpha* Le Cerf (Bolivia, Rio Songo, Pebas), *E. a. vicaria* Le Cerf (higher Amazonas); *Echenais pulcherrima felicis* Lathy (SE Colombia); *Dysmathia juno* Le Cerf (Colombia, Rio Putumayo), *D. grosnyi* Le Cerf (Brazil, Rio Tapajoz). Most types in National Museum, Paris. In this important paper, one may only regret that many specific names are written with a capital letter. [P. V.]

Rebillard, P., & P. Viette, "Les types d'*Agrias* de la collection de Mme. G. Fournier de Horrack (Lep. Nymphalidæ)" [in French]. *Bull. Soc. ent. France,* vol.65: pp.109-117. 1960. List of the 137 holotypes or lectotypes of *Agrias* in this collection, now in the Paris Museum. Types of taxa described chiefly by Lathy, Le Moult, & O. Michael. [P. V.]

Reiss, H., "*Zygæna ephialtes* L. subsp. *parisica* n. subsp. (Lép.)" [in French]. *Bull. Soc. ent. Mulhouse,* 1959: pp.57-59. Description of new subspecies (Orgemont). The title is badly presented with the "L." and "subsp." interpolated. [P. V.]

Reisser, Hans, "Ergebnisse der Österreichischen Iran-Expedition 1949/50. Lepidoptera I. (Macrolepidoptera)" [in German]. *Sitzungsber. österr. Akad. wiss., math.-naturw. Kl., Abt.1,* vol.167: pp.519-551, 9 pls., 1 map. 1958. Describes as new *Discestra loeffleri* & *Cucullia leptographa* (Noctuidæ; from tea house between Isfahan & Gom). Annotated list of 75 spp. (16 families) with descriptive notes on some spp. [P. B.]

Reisser, Hans, "Neue Heteroceren aus Kreta" [in German]. *Zeitschr. wiener ent. Ges.,* vol.43: pp.105-128, 1 pl., 7 figs. 1958. Describes as new *Ochropleura* (*Dichagyris*) *melanura rhadamanthys* (Rouwa Forest, Mt. Ida, 1300 m.); *Auchmis comma minoica* (Assites, 500 m.); *Autophila anaphanes cretica* (Guverneto Monastery, Akrotiro Peninsula), *A. dilucida troničeki* (Agnoja); *Caradrina* (*Eremodrina*) *pseudopertinax cretica* (Rouwa Forest, Mt. Ida, 1300 m.); *Ennomos* (*Deuteronomos*) *duercki* (Rouwa Forest, Mt. Ida, 1300 m.); *Hemerophila trypanaria cretacaria* (Rouwa Forest; foodplant privet); *Mannia psyloritaria* (Rouwa Forest, 1400 m.); also 2 "forms". Describes early stages of *C. p. cretica* & *H. t. cretacaria.* Gives list of spp. recorded from Crete since Rebel's list (1916). [P. B.]

Reissinger, Eduard, "Zur Taxonomie einiger Formen von *Colias australis,* insbesondere des Lectotypus von *Colias hyale australis* Verity (1911) (Lep. Pieridæ)" [in German]. *Nachrichtenbl. bayer. Ent.,* vol.8: pp.113-122. 1959. Reviews all names which might apply to this species, and rejects all older than *australis.* The series on which the name *australis* is based includes specimens of *hyale* as well, and the locality is suspect. The lectotype definitely belongs to this species, however, and the given locality (Andalusia) might be right. Discusses geographic variation & distribution; raises *untercalida* to rank of subspecies (S. France only). Genitalic distinction between *australis* & *hyale* appears to be unreliable because of variation in both spp. [P. B.]

Remington, P. S., "More problems with *Problema* in Kansas (Hesperiidæ)." *Journ. Lepid. Soc.,* vol.13: pp.15-16. 1959.

Richardson, Austin, & Robin M. Mere, "Some preliminary observations on the Lepidoptera of the Isles of Scilly with particular reference to Tresco." *Ent. Gazette,* vol.9: pp.115-147, 2 pls. 1959. Richardson describes as new *Eumichtis lichenea scillonea* and *Agrotis puta insula* (Tresco, Scilly Isles, Cornwall, England) and names several "abs." General description of islands, discussion of fauna, and annotated list of spp. (including micros). [P. B.]

Riley, N. D., "The genera of holarctic Theclinæ: a tentative revision." *Proc. 10th internat. Congr. Ent.,* vol.1: pp.281-288. 1958. General discussion, division into groups, and key to genera (type species indicated). Revision based largely on ♂ genitalia. [P. B.]

Rindge, Frederick H.. "An additional synonym in *Annaphila* (Lepidoptera, Phalænidæ)." *Journ. New York ent. Soc.,* vol.60: p.172. 1952. *A. arvalis* (=*Brephos fletcheri*). [P. B.]

Rindge, Frederick H., "A revision of the American species of *Deilinea* (Lepidoptera, Geometridæ)." *Amer. Mus. Novit.,* no.1810: 31 pp., 30 figs. 1916. Reduces *bryantaria* to ssp. of *exanthemata,* & *undularia* to ssp. of *erythemaria.* Sinks *pacificaria* to *erythemaria* & *solamata* to *borealis.* Redescription of genus and 6 American forms, with keys and distribution maps. Speculation on relative priority of *Deilinea* & *Cabera.* [P. B.]

Rindge, Frederick H., "Descriptions of and notes on North American Geometridæ (Lepidoptera)." *Amer. Mus. Novit.*, no.1784: 19 pp., 19 figs. 1956. Describes as new *Eupithecia uinta* (Uinta Mts., Uinta Co., Utah); *Hydriomena peratica* (Pine Crest, Mt. Graham, Pinoleno Mts., Ariz., 7300 ft.). Sinks *Glena cribrataria* to *G. fuliginaria; Itame crassata* to *G. cognataria; Jenana* to *Chesiadodes.* Keys to spp. of *Pseudoboarmia* (including *luridula*) & *Chesiadodes.* Sinks *Euchlæna vinulentaria* to *E. nodusaria;* transfers *deplanaria* from *Ellopia;* places *astylusaria* as ssp. of *amœnaria.* Descriptive notes on *Eupithecia slossonata* & *E. jejunata.* [P. B.]

Rindge, Frederick H., "Descriptions of and notes on North American Geometridæ (Lepidoptera), no.2." *Amer. Mus. Novit.*, no.1872: 23 pp., 29 figs. 1958. Describes as new *Stamnodes artemis* (Pinery Canyon, Chiricahua Mts., Cochise Co., Ariz.), *S. lampra* (Madera Canyon, Santa Rita Mts.. Pima Co., Ariz); *SPERRYA* (monobasic), *S. cervula* (Patagonia, Santa Cruz Co., Ariz.); *Galenara olivacea* (Pinery Canyon), *G. stenomacra* (Coulters Ranch Camp, S. fork of Little Colorado R., White Mts., Apache Co., Ariz.); *Carphoides setigera* (Pinery Canyon); *Stenoporpia mediatra* (Pinery Canyon). Notes on *Hydriomena arizonata* & *Glena cognataria* (synonymy). *Psaliodes fervescens* new to USA. [P. B.]

Rindge, Frederick H., "Descriptions of and notes on North American Geometridæ (Lepidoptera), no.3." *Amer. Mus. Novit.*, no.1910: 24 pp., 26 figs. 1958. Describes as new *Sterrha insulensis* (Tavernier, Monroe Co., Fla.); *Semiothisa sanfordi* (Port Sewell, Martin Co., Fla.); *Mericisca scobina* (Southwest Research Station, Cochise Co., Ariz., 5400 ft.); *Merisma ceræa* (Pine Crest, Mt. Graham, Pinaleno Mts., Graham Co., Ariz., 7300 ft.); *Glena arcana* (Huachuca Mts., Ariz.); *Euchlæna silacea* (Vineyard, Utah Co., Utah); *Pityeja ornata* (Southwestern Research Station). Sinks *Macaria transitaria* to *Semiothisa distribuaria.* Transfers *Mericisca fumida* to *Ultracis.* [P. B.]

Rindge, Frederick H., "A revision of *Glaucina, Synglochis,* and *Eubarnesia* (Lepidoptera, Geometridæ)." *Bull. Amer. Mus. nat. Hist.*, vol.118: pp.261-365, 5 pls., 106 figs. 1959. Describes as new *G. biartata* (Rosario, Baja Calif.), *G. cilla* (Vidal, San Bernardino Co., Calif.), *G. bæa* (Borrego, San Bernardino Co., Calif.), *G. eupitheciaria lucida* (Palm Springs, Riverside Co., Calif.), *G. e. escariola* (18 mi. N. of Rodeo. Hidalgo Co., New Mexico), *G. ampla* (upper Santa Ana R., San Bernardino Co., Calif.), *G. bifida* (Split Rock Tank, Mohave Desert, Riverside Co., Calif.), *G. gertschi* (Matachic, Chihuahua, Mex.), *G. gonia* (upper Santa Ana R., San Bernardino Co., Calif.), *G. g. microgonia* (Independence, Inyo Co., Calif.), *G. platia* (Inyo Mts., 9000 ft., Inyo Co., Calif.), *G. nephes* (Rock Creek Canyon, El Paso Co., Colo.), *G. spina* (San Pedro, Mexico City, D. F., Mex.), *G. panda* (Actopan, Hidalgo, Mex.), *G. dispersa* (Frijoles Canyon, Bandelier National Monument, Sandoval Co., New Mex.), *G. nota* (Davis Mts., Tex.), *G. eureka agnesæ* (Palm Springs, Riverside Co., Calif.), *G. loxa* (Trout Creek, Ibapah Mts., Juab Co., Utah), *G. anomala* (Redington, Pima Co., Ariz.): *E. ritaria arida* (Borrego, San Diego Co., Calif.); *PARAGLAUCINA* (type *G. hulstinaria*). 38 spp. in 4 genera, all from SW U.S. & Mexico. Keys to genera & spp. [P. B.]

Rindge, Frederick H., "Descriptions of and notes on North American Geometridæ (Lepidoptera), no.4." *Amer. Mus. Novit.*, no.1968: 17 pp., 13 figs. 1959. Describes as new *Semiothisa cydica* (Tehuacan, Puebla, Mexico); *Stenoporpia asymmetra* (Pinery Canyon, Chiricahua Mts., Cochise Co., Ariz.). Revision of *s-signata* group of *Semiothisa,* including also *S. cyda* & *S. melanderi.* [P. B.]

Roepke, W., "The genus *Nyctemera* Huebner. II." *Tijdschr. Ent.*, vol.100: pp.147-178, 2 pls., 12 figs. 1957. Describes as new *N. floresicola clarior* (Kaju Aro, Mt. Korintji, 1600 m., Sumatra), *N. f. corbeti* (Bukit Kutu, Malaya), *N. malaccana* (Pahang, Cameron Highlands, 4000 ft., Malaya), *N. æres vandenberghi* (Minahassa, Celebes), *N. baulus moluccana* (Halmahera), *N. muelleri enganica* (Engano), *N. tripunctaria simalura* (Simalur); also several "forms". Revision of spp. from

Sumatra & Malaya, and discussion of various spp. from other parts of the oriental region. [P. B.]

Roepke, W., "Das Weibchen von *Delias benasu* Martin" [in German]. *Zool. Meded.*, Leiden, vol.36: pp.299-301, 1 pl. 1959. Describes & figures first known ♀ of Celebes sp. [P. B.]

Rougeot, P. C., "Description d'une nouvelle espèce d'*Orthogonioptilum* (Lépid. Attacide) du Gabon" [in French]. *Bull. mens. Soc. linn. Lyon,* vol.27: pp.140-142, 4 figs. 1958. Describes as new *O. vitreatum* (Gaboon); the location of the holotype is not indicated; probably, unfortunately, in the author's collection. [P. V.]

Rougeot, P. C., "Une nouvelle forme d'*Orthogonioptilum* (Lepid. Attacidæ)" [in French]. *Entomologist,* vol.91: p.253. 1958. Describes as new *O. ochraceum* (3800-4100 ft., Ituri Forest, Belgian Congo). [P. B.]

Rougeot, P.- C., "Sur une nouvelle forme de *Micragone* (Lépid. Attacide)" [in French]. *Bull. mens. Soc. linn. Lyon,* vol.28: pp.280-281, 1 fig. 1959. Description of a new species of saturniid: *M. colettæ* (French Congo, Libreville district, N'Toum). [P. V.]

Rougeot, P.- C., "Description d'un nouveau *Lobobunæa* du Kénya" [in French]. *Bull. Soc. ent. France,* vol.64: pp.187-188. "1959" [1960]. Describes as new *L. jeanneli* (Marakwet, Elgeyo Escarpment, 2500 m.). [P. B.]

Rougeot, P.- C., "Un nouvel *Orthogonioptilum* du Gabon (Lep. Attacidae)" [in French]. *Bull. Soc. ent. France,* vol.64: pp.231-232. "1959" [1960]. *O. ianthinum,* a new saturniid from Gaboon (Lastourville). [P. V.]

Rousseau-Decelle, G., "Note sur une sous-espèce nouvelle de *Charaxes* africain (Lep. Nymphalidæ)" [in French]. *Bull. Soc. ent. France,* vol.61: pp.91-92, 1 pl. 1956. Describes as new *C. bipunctatus johnsoni* (Amentia, Gold Coast). [P. B.]

Rungs, Ch., "Contribution à l'étude du genre *Sesamia* Guen. à Madagascar (Lep. Phalænidæ)" [in French]. *Mém. Inst. scient. Madagascar, ser. E,* vol.5: pp.155-167, 1 pl., 5 figs. 1954. Study of the species of *Sesamia* in Madagascar with description of *S. viettei* (Madagascar). [P. V.]

Rungs, Ch., "Lépidoptères du Tassili n'Ajjer" [in French]. *Inst. Recherches sahariennes, Univ. Alger—Mission scient. Tassili des Ajjer (1947).* vol.3: pp.167-176, 1 fig. 1958. List of a small collection of Lepidoptera from locality in NE Sahara; description of *Clytie bernardi* (Noctuidæ Catocalinæ). [P. V.]

Salmon, J. T., & J. D. Bradley, "Lepidoptera from the Cape Expedition and Antipodes Islands." *Rec. Dominion Mus.,* Wellington, vol.3: pp.61-81, 45 figs. 1956. Salmon describes as new: (Arctiidæ) *Nyctemera annulata antipodea* (Antipodes Is.); (Pyraustidæ) *Mecyna antipodea* (above Ringdove Bay, Antipodes Is.); *Scoparia albafascicula* (Campbell Is.); (Melanchridæ) *Melanchria oceanica* (Ocean Is.); (Hydriomenidæ) *Xanthorhoe subantarctica* (Campbell Is.). The authors jointly describe as new: (Tineidæ) **ANTIPODESMA* (monobasic), *A. turbotti* (above Ringdove Bay, Antipodes Is.); (Hyponomeutidæ) *TINEARUPA* (monobasic), *T. sorenseni* (Courjolles Peninsula. Campbell Is.); **CAMPBELLANA* (monobasic), *C. attenuata* (Campbell Is.); (Cosmopterygidæ) *REDUCTODERCES* (monobasic), *R. fuscoflava* (Campbell Is.); (Tortricidæ) *Epagoge parallela* (Aukland Is.); **SORENSENATA* (monobasic), *S. agilitata* (Campbell Is.); (Crambidæ) *EXSILIRARCHA* (monobasic), *E. graminea* (Campbell & Aukland Is.). Starred genera are brachypterous; all are said to resemble small grasshoppers in appearance & behavior. *Euprotodes galathea* (Campbell Is.) is redescribed. Some other known spp. are recorded. [P. B.]

Sarlet, L., "A propos de *Callimorpha quadripunctaria* Poda (=*hera* L.)" [in French]. *Lambillionea,* vol.58: pp.75-76. 1958. Note on *C. quadripunctaria* in S. France. [P. V.]

Sattler, K., "Ein Beitrag zur Kenntnis der Gattung *Aroga* Busck (Lep. Gelechiidæ)" [in German]. *Rev. franç. Ent.,* vol.27: pp.236-239, 4 figs. 1960. List of the species of *Aroga* in the palearctic; describes as new *A. temporariella* (France, Alps, Digne). [P. V.]

Sattler, Klaus, "Generische Gruppierung der europäischen Arten der Sammelgattung *Gelechia* (Lepidoptera, Gelechiidæ) (auf Grund der Untersuchungen der männlichen und weiblichen Genitalarmaturen)" [in German]. *Deutsche ent. Zeitschr.*, N. F., vol.7: pp.10-118, 31 pls., 2 figs. 1960. Describes as new *NEOFRISERIA* (type *Lita peliella*), *N. caucasiella* (Caucasus); *ALTENIA* (type *Gelechia perspersella*); *GLADIOVALVA* (type *Gelechia rumicivorella*), *G. pseudodorsella* (Tachdirt, 2200-2700 m., High Atlas, Morocco); *Teleiopsis* (type *Recurvaria affinis*). Proposed *Teleiodes* n.n. for *Teleia* Heinemann, nec Hübner. All available European spp. of *Gelechia* s.l., and a few spp. previously referred to other genera, are treated and assigned (sometimes tentatively) to genera. Phylogeny, especially in *Gelechia* s.str. and *Chionodes*, is discussed. Genitalia of many spp. are figured. [P. B.]

Schadewald, Gerhard, "*Colias australis calida* Verity und *hyale* L. (Lep. Pieridæ) bei Jena in Thüringen" [in German]. *Nachrichtenbl. bayer. Ent.*, vol.8: pp.49-52, 2 figs. 1959. Distinguishes spp. in all stages. [P. B.]

Schmidt, Günther, "Deutsche Namen von Schadinsekten" [in German]. *Mitt. biol. Bundesanst. f. Land-und Forstwirt.*, vol.84: 174 pp. 1955. List German names and specific scientific names alphabetically; index list of generic names. Only insects of medical or agricultural importance included. [P. B.]

Schütze, Eduard, "Eupithecien aus Tripolitanien. Eupithecien-Studien XII" [in German]. *Zeitschr. wiener Ent. Ges.*, vol.44: pp.151-157, 3 pls., 2 figs., 1 map. 1959. Describes as new *E. jefrenata, E. floriata, E. tripolitaniata, E. subextremata;* records of 3 other spp. All from Jefren, 713 m., Tripolitania. [P. B.]

Schütze, Eduard, "Neue Eupithecien aus Griechenland. Eupithecien-Studien XIII" [in German]. *Mitt. münchner ent. Ges.*, vol.49: pp.35-38, 1 pl. 1959. Describes as new *E. danielata* & *E. denotata hellenata;* records *E. scalptata;* all from Mt. Olympus. [P. B.]

Schütze, Eduard, "Alte und neue Eupithecien aus Iran (Lep. Geom.). Eupithecien-Studien XV" [in German]. *Mitt. münchner ent. Ges.*, vol.50: pp.1-23, 13 pls. 1960. Describes as new *E. elbursiata* (N. Persia, Elburs, Tacht i Suleiman, Särdab Valley, 2900-3200 m.), *E. icterata iranata* (Särdab Valley, 1900-2700 m.), *E. pseudoicterata* (Särdab Valley, 2500-2700 m.); subgenus *BOHATSCHIA* (type *E. venosata*), *E.* (*B.*) *problematicata* (same locality). *E.* (*B.*) *pfeifferata* (Särdab Valley, Vandarban, 1900-2200 m.); *E.* (*Dietzea*) *forsterata* (Särdab Valley, Vandarban, 2500-2700 m.). 14 spp. are tentatively assigned to *E.* (*Bohatschia*). 30 spp. in all are recorded from Iran, with some descriptive notes. [P. B.]

Seppänen, Eino J., "*Eupithecia selinata* H. S. (Lep. Geometridæ) neu für Nordeuropa, in Finnland gefunden" [in German]. *Ann. ent. fennici*, vol.22: pp.84-89, 3 figs. 1956. Reports the species from several localities in southern Finland. Figures ♂ and ♀ genitalia of *E. selinata* & *E. trisignaria.* Describes larva, pupa, & biology of *E. selinata.* [W. H.]

Sieder, Leo, "Neue palæarktische Psychiden (Lepidoptera, Psychidæ)" [in German]. *Zeitschr. wiener ent. Ges.*, vol.44: pp.145-150, 1 pl. 1959. Describes as new *Sciopetris amseli* (Herat-Kala, Nao Kashka Pass, 1800 m., W. Afghanistan); *PELOPONNESIA* (and PELOPONNESIINÆ) (monobasic), *P. megaspiliella* (Megaspiläon, Chelmos region, 1000 m., Greece). [P. B.]

Sperry, John L., "Another synonym, Lepidoptera, Geometridæ." *Bull. Brooklyn ent. Soc.*, vol.47: p.83. 1952. Transfers *Lygris pulcherrima* to *Snowia* (Ennominæ) & sinks *Azelina waltonaria* to it.[P. B.]

Sperry, John L., "A *Racheospila* species from Tulare Co., California apparently undescribed. (Lepidoptera, Geometridæ)." *Bull. Brooklyn ent. Soc.*, vol.48: pp.26-27. 1953. Describes as new *R. hennei* (Smoky Valley, Tulare Co.). [P. B.]

Stallings, Don B., & J. R. Turner, "The names for the suprageneric categories of the Megathymidæ." *Lepid. News,* vol.12: pp.93-94. 1959. Proposes new tribe AGATHYMINI.

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The object of The Lepidopterists' Society, which was formed in May, 1947, and formally constituted in December, 1950, is "to promote the science of lepidopterology in all its branches, ... to issue a periodical and other publications on Lepidoptera; to facilitate the exchange of specimens and ideas by both the professional worker and the amateur in the field; to secure cooperation in all measures" directed toward these aims (*Constitution*, Art. II). A special goal is to encourage free interchange among the lepidopterists of all countries.

Membership in the Society is open to all persons interested in any aspect of lepidopterology. All members in good standing receive the *Journal* and the *News of the Lepidopterists' Society*. Institutions may subscribe to the *Journal* but may not become members. Prospective members should send to the Treasurer the full dues for the current year, together with their full name, address, and special lepidopterological interests. All other correspondence concerning membership and general Society business should be addressed to the Secretary. Remittance in dollars should be made payable to *The Lepidopterists' Society*. There are three paying classes of membership:

Active Members — annual dues $6.00 (U. S. A.)

Sustaining Members — annual dues $15.00 (U. S. A.)

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Dues may be paid in Europe to our official agent: E. W. Classey, 353 Hanworth Road, Hampton, Middx., England.

In alternate years a list of members of the Society is issued, with addresses and special interests. All members are expected to vote for officers when mail ballots are distributed by the Secretary annually. There are four numbers in each volume of the *Journal*, scheduled for February, May, August, November, and eight numbers of the *News* each year.

The Lepidopterists' Society is a non-profit, scientific organization. The office of publication is New Haven, Connecticut (see address inside back cover). Application for Second-class mail privileges has been approved at New Haven, Connecticut.

Journal of The Lepidopterists' Society

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JAMES HALLIDAY McDUNNOUGH (1877 - 1962)

A BIOGRAPHICAL OBITUARY AND BIBLIOGRAPHY

by Douglas C. Ferguson

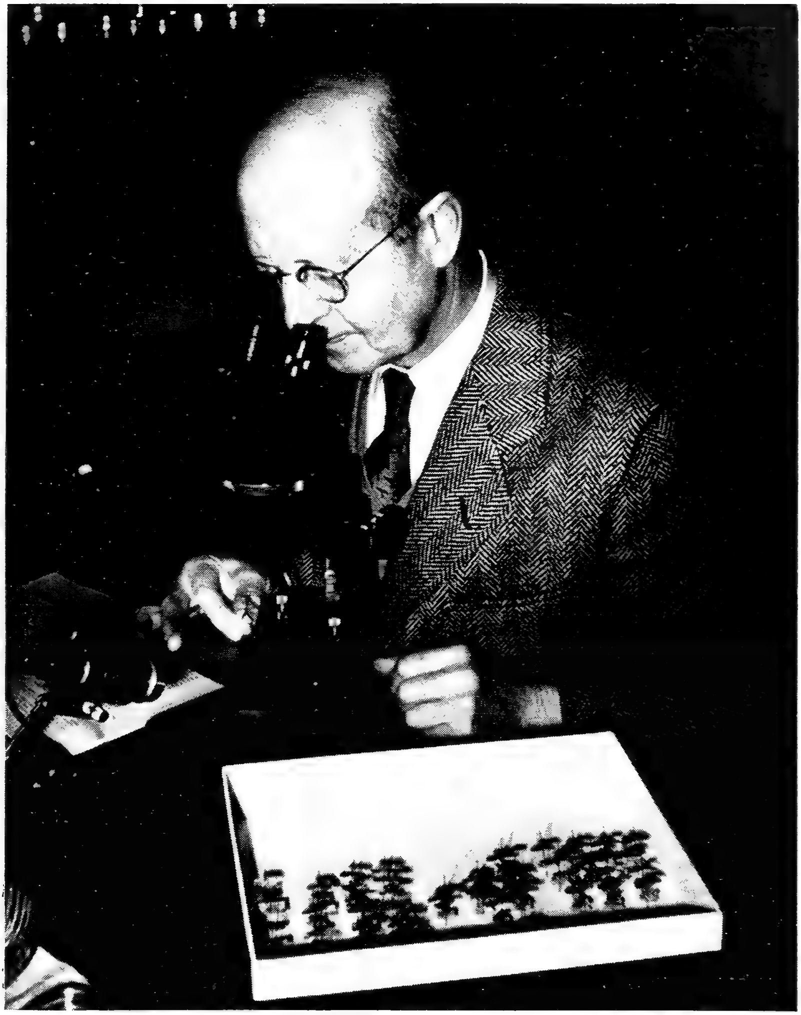
On February 23, 1962, Dr. James H. McDunnough died at the Victoria General Hospital, Halifax, Nova Scotia, at the age of 84. Dr. McDunnough had a long and varied career, and continued his taxonomic work until November 1961, when failing health forced him to cease activity. His final paper, "Notes on the Coleophoridæ of the Maritime Provinces of Canada", was published just one week before his death. He was one of the most prominent figures in systematic entomology for half a century and for much of this period was perhaps the leading authority on this continent in two diverse orders of insects – the Lepidoptera and Ephemerida.

Dr. McDunnough was born at Toronto, Ontario, on May 10, 1877, and there received his early education at private schools and at Jarvis Street Collegiate. In 1897 he went to Berlin, Germany, to continue his education and was trained for a career in music. He was privileged to be a pupil of Josef Joachim, one of the most celebrated violinists of his day. McDunnough also enjoyed the rare experience of meeting other eminent musical figures such as Richard Strauss, who was once guest conductor of the Glasgow Orchestra in which McDunnough played, and Alexander Glazunov, who was a familiar visitor at the house of a Russian family where McDunnough tutored languages. Following completion of his musical studies, McDunnough played one season as a professional violinist with the Symphony Orchestra of Glasgow, Scotland, probably in 1903-04. This experience was the turning point in his career, for he then decided to abandon music as a vocation, although his interest remained.

In 1904 McDunnough returned to Berlin and began a course of study in zoology at the Kaiser Wilhelm Institut. At the same time, he enrolled in an extramural course at Queen's University, Kingston, Ontario. In 1909 he was granted the Ph.D. from Berlin, and the M.A. degree from Queen's. That same year he returned to North America, and on October 22 married Margaret Bertels, from Berlin. McDunnough's first job after graduation was with the Marine Biological Laboratory, Woods Hole, Massachusetts, but once there, he soon learned of an important opportunity being offered in Lepidoptera taxonomy by Dr. William Barnes. Early in 1910, he became curator of Barnes' private collection at Decatur, Illinois. According to Dr. McDunnough, the salary for that position was one hundred dollars per month, and this was considered very generous remuneration at that time.

It is not certain how McDunnough first became interested in Lepidoptera. He was an amateur collector in his student days in Toronto, and a member of the Toronto branch of the Entomological Society of Ontario. This is commemorated by a published photograph of members of that group taken in 1896 (*Can. ent.* 71: pl.7; 1939). Dr. T. N. Freeman, in an obituary just published (*Can. ent.* 94: 1094-1102; 1962), states that McDunnough was a member of a group of young naturalists, including Arthur Gibson, E. M. Walker and R. S. Lillie, who formed an amateur biological club in Toronto just before 1900. McDunnough also associated with a Toronto piano-maker, Paul Hahn, who was an amateur naturalist and may have influenced him. This interest continued as a side line during the period of McDunnough's musical training, and he did some collecting around Berlin and in the Alps. It is unlikely that he had any serious intention of making a career of taxonomy before his contact with Barnes. He had little, if any, specific instruction in systematics apart from general courses in zoology and botany, and although his doctoral research dealt with an insect, *Chrysopa perla* L. (Neuroptera), it was limited to problems of anatomy and histology. Thus after two consecutive and distinct programs of higher education, McDunnough returned to his boyhood interest in Lepidoptera when afforded the opportunity of a profession in the field of taxonomy.

Dr. William Barnes, an eminent surgeon of Decatur, Illinois, possessed a collection of North American Lepidoptera that was at that time the finest in existence, and he was in a position to employ a full time curator to develop it and to engage in research. Dr. McDunnough was the first of three such curators, followed by A. W. Lindsey and F. H. Benjamin. During the nine years that they were associated, Barnes and McDunnough published jointly a total of 67 papers, including those



that fill the first four volumes of *Contributions to the Natural History of the Lepidoptera of North America,* which was established for them by BARNES. From Decatur, Dr. MCDUNNOUGH made some memorable collecting trips to what were then rather remote areas, such as southern Florida, Silverton, Colorado, and Mt. Rainier, Washington.

Although he published only nine papers during this time without the stated co-authorship of BARNES, it has been established that MCDUNNOUGH was fully responsible for the research and preparation involved in all of the joint papers (see the Barnes biography by JEANNE E.

Remington, *Lepidopterists' news* 3: 53-54; 1949). A similar relationship prevailed between Barnes and his later co-authors, Lindsey, Benjamin, and Busck. In a letter to Mrs. Remington, quoted in the above paper, Dr. McDunnough wrote: "With regard to publications, Barnes' *only prepared* papers appeared in *Candidian Entomologist* 1901, 1904, 1905, etc. and *Entomological News,* vol.11. After 1909 his curators were *entirely* responsible for articles in journals and for the entire five volumes of the 'Contributions'. This latter publication was financed by Barnes' sister-in-law, Miss Jessie Gillett. Barnes' name, as owner of the collection, appeared as a courtesy to the man who paid the curators' salaries. A single paper, published under Barnes' name in *Pan-Pacific Entomologist,* vol.5, no.1, in 1928 was probably prepared for the most part by Benjamin. The Check Lists were also the work of the curators. Barnes, in my time, never did any lengthy studies on the Lepidoptera; he used to drop in in the morning and usually for a short time in the evening to discuss work, etc., and when time was available, spent it studying Phalænids, particularly members of the genus *Euxoa* in which he was greatly interested." Mrs. Remington also quotes from a letter written by Dr. A. W. Lindsey, confirming the above information, saying: "Dr. Barnes' work in entomology was chiefly the lavish support of collectors and the provision of a superb opportunity for the research done by his curators. He described some species, but did no actual taxonomic research as far as I know."

Apart from the *Contributions,* the other major Barnes and McDunnough works were the 1917 check list and the *Illustrations of the North American Species of the Genus Catocala* (1918). The latter, a collection of superb colored figures mostly by Mrs. William Beutenmuller, combined with a brief but very useful text, remains to this day the finest single work on the American Catocalas. The great collection of Dr. Barnes, with its many types, was later sold to the Smithsonian Institution.

During the years at Decatur, McDunnough maintained an active interest in music. There he played both the violin and the viola. The following is quoted from a social note in the Decatur Herald, probably published in March, 1919: "Dr. and Mrs. James McDunnough are leaving Decatur next week for Ontario, Canada, where Dr. McDunnough will take a place as entomologist with the Dominion Government . . . . . A large and valuable collection of ensemble music has been given by Dr. McDunnough to the Millikin Conservatory this week. Dr. McDunnough has given a great deal of time to the study of

music and has been a member of the Millikin Conservatory Quartet. He played the viola in this quartet . . . . . Referring to the gift M. L. SWARTHOUT, the director of the Conservatory, said: 'It is certainly a splendid addition to our library. But we are mighty sorry to have Dr. McDUNNOUGH leave. One seldom finds in a city the size of Decatur, so splendid a musician who is not a professional' ".

In describing the period at Ottawa, I cannot do better than quote from an excellent little article on McDUNNOUGH written by one of his Ottawa associates, coleopterist Mr. W. J. BROWN (*Entomology Division Newsletter,* Canada Dept. of Agric., 33(10): 2-3; 1955).

"Dr. McDUNNOUGH spent the summer of 1918 in Ottawa, where he arranged the macrolepidoptera in the Canadian National Collection, and in April, 1919, he left Dr. BARNES and returned to Ottawa as chief of the newly created Division of Systematic Entomology. He was thus the first officer appointed to devote full time to the National Collection and to an identification service for field officers and others. Working without technical assistance until 1922, he undertook: (1) to sort the large accumulation of unclassified material and to combine the organized collections that had been acquired by the Entomological Branch; (2) to acquire new material from faunal surveys and from other entomologists; and (3) to build a suitable library. This led to expanding interests; although his interest in Lepidoptera did not diminish, he began to publish on other insects in 1921. He served 28 years in Ottawa. When he was superannuated in November, 1946, he had developed, with a small staff and from small beginnings, an organized collection of pinned material that occupied approximately 3,000 drawers, as well as large collections in alcohol and on slides. The National Collection contained type material of 5,690 North American species; it had become one of the most important collections of North American insects, and it was supported by a library of approximately 4,000 bound volumes on taxonomic and general entomology, plus many thousand pamphlets and authors' separates. Dr. McDUNNOUGH himself had conducted faunal surveys in all provinces except Saskatchewan [and Newfoundland] and had published [at Ottawa] 199 taxonomic papers, of which 153 were on Lepidoptera, 38 on Ephemeroptera, five on Odonata, two on Diptera, and one on Hemiptera. Among the outstanding papers of this group are studies on the geometrids of the tribe Cleorini (1920); revisions of the North American genera and species of agrotid moths (1928) and of the phalænid subfamily Plusiinæ (1944); studies on adults and nymphs of the mayfly genus *Ephemerella* (1931); a revision of the tortricid genus *Peronea* (1934); and a check list of the Lepidoptera of Canada and the

United States . . . (1938, 1939)". McDunnough edited *The Canadian Entomologist* from 1921 to 1938.

Dr. McDunnough was better known as a lepidopterist, but his contributions in the Ephemerida are of the greatest importance to students of that order. He described, in addition to a number of genera, 210 species of Nearctic mayflies, more than any other author, and published some important revisional papers. In the prefatory note to *The Biology of Mayflies* (Needham, Traver, and Hsu; Comstock Publishing Co.; Ithaca, N. Y.; 1935), James G. Needham said of him: "Doctor McDunnough, who has made the greatest additions to the knowledge of our mayfly fauna, has aided us by gifts of specimens, by loan of rare material, and by much good advice. It fell to him to make the first thorough-going effort to identify the poorly described species of the older authors, and to properly attach the names they gave. This was a task of enormous difficulty, owing to the loss of many types, the fragmentary condition of others, and the immature and ill-preserved condition of still others. Absolute certainty as to the species that the older authors had before them is now impossible in some cases; but we believe that Doctor McDunnough's results are not likely to be bettered, and we have in nearly all cases followed his usage. It provides a new basis from which future work may proceed". Similar remarks could apply to so many of his works in the Lepidoptera.

In November, 1946, McDunnough was appointed a Research Associate, Department of Insects and Spiders, American Museum of Natural History, and moved from Ottawa to New York city. The following three years were among the most productive of his career, and he enjoyed his New York associates and the fine facilities provided by the Museum. He disliked the large city, however, and missed the long periods of summer field work to which he had been accustomed. His wife Margaret died on February 11, 1950 and following this, he decided to go to Nova Scotia where, in previous years, he had spent much time collecting. In addition to a number of shorter papers, McDunnough produced three major revisions at the American Museum. It was one of these, the "Revision of the North American Species of the Genus *Eupithecia*" (1949), that he considered to be his finest work. The revision of the eastern North American species of the noctuid genus *Euxoa* is also one of his best contributions. The third major work, "The Saturniidæ of North America", for which were prepared nearly 200 colored figures by Miss Marjorie Statham, is still unpublished.

Dr. McDunnough arrived in Halifax on June 2, 1950 and lived there the remainder of his life, working as a Research Associate of both the

American Museum of Natural History and of the Nova Scotia Museum of Science. The American Museum published his papers and the Nova Scotia Museum provided space and facilities for the continuation of his studies. McDunnough completed 20 papers at the Nova Scotia Museum, including the large revision of the genus *Hydriomena* (1954), and continued active collecting almost every summer about Halifax or at White Point Beach, Queens County, N. S.

I had introduced myself to Dr. McDunnough in August, 1944 near the little town of Parrsboro, Nova Scotia, where he was engaged in field work and where I had gone for the purpose of meeting him. We met again in 1945, and in 1946 I worked as his summer assistant at Annapolis Royal. Later, during the 12-year period at Halifax, I worked closely with McDunnough and knew him well. I collected large numbers of microlepidoptera to supplement those from his own field work, spread his material, and made the photographs for his papers. With limited

museum funds we assembled the nucleus of a library. In return, he endeavoured to leave with me a heritage of specialized knowledge and technique. We had countless discussions on almost every topic, with few disagreements.

The attitude of his earlier years must have been somewhat different, but during the 18 years that I knew McDunnough he showed little patience with new ideas and tended at times to be critical of anything he did not understand. He shunned meetings and social gatherings, and perhaps for this reason had few scientific friends apart from immediate associates. He enjoyed association with others but seemed unwilling to admit it. His steadfast independence was a most pronounced characteristic; yet whenever he lived or worked too long in isolation his disposition deteriorated. Those who made the effort to gain his acquaintance found McDunnough a meticulous person of superior manners, humour and generosity, combined with a manner of unusual frankness which, on occasions, probably led to misunderstandings of his personality.

The McDunnough characteristic most puzzling to me was his total disinterest in all other aspects of natural history. It is doubtful if he ever looked at the museum exhibits, either here or at New York. I remember observing, with astonishment, that he did not know the names of even the most familiar birds. After one of his many visits to the nearby Public Gardens in Halifax, McDunnough once asked me about some of the birds that had happened to be especially evident that day. These were Canada geese and starlings! His knowledge of the flora was, through necessity, much better, but still limited to essentials.

Similarly, McDunnough bothered little about the relationship of his taxonomic work to other branches of biology. He was not a gamma taxonomist. He probably understood and accepted the concept of evolution, but showed no interest in discussing it or in speculating upon its implications. He avoided controversy and did not like to "stick his neck out". Such fields as genetics, ecology, and zoogeography were completely foreign to him, or at least he thought they were, although in his 50 years of published observations there is surely a wealth of information as basic to these subjects as to taxonomy. His favourite comment on genetics was the recitation of a limerick, unquotable in this context, illustrating Mendelian heredity. But there is no doubt that McDunnough possessed that essential quality of the good taxonomist that he called "a good eye for species". Of almost 1,500 new names that he proposed, it appears that the incidence of synonymy will be extremely low. His

conclusions, as far as they went, were as accurate and as well substantiated as he could make them within self-imposed limitations of time. He usually worked rapidly on just one problem at a time, and it seemed that he could not rest until it was finished.

Dr. McDunnough wrote little about his own life or experiences. It was characteristic of his style to write objectively, remain strictly with the subject and, I believe in part out of modesty, to avoid publishing anything that might be construed as autobiographical. This he would have considered superfluous. McDunnough lived an austere and orderly life. By keeping his affairs as simple as possible he was able to direct nearly all of his energy into his work. He had no religious affiliations of any kind, and described himself as an agnostic. The diverse distractions of twentieth century urban life affected him little, and the automobile, airplane, cinema and television were to McDunnough of little or no consequence. Although at one time in the 1920's he did learn to drive, this encounter with the automobile appears to have been brief. He was not mechanically inclined. McDunnough had no children and, after the death of his wife, no close relatives except a sister, Miss Grace McDunnough, who survives him and lives in London, England. He kept few possessions, but after coming to Halifax indulged in the collecting of phonograph records. He had a fine collection of disks, mostly chamber and orchestral music of the classical and romantic periods. Apart from music, he enjoyed golf, bridge, crossword puzzles, and was an avid reader of mystery and crime fiction.

Dr. McDunnough was a Fellow of The Entomological Society of Society and a cordial and helpful friend to the early moves towards its formal establishment. In October 1950 he accepted the position of President *pro tempore* at the urging of the Organization Committee which, under the chairmanship of McDunnough's friend Cyril F. dos Passos, had just presented the draft of the Constitution and By-laws. In the mail ballot held at the end of 1950, Dr. McDunnough was elected for the year 1951 as the first President of the Society. In 1952 he was elected by mail ballot of the Society members as one of the five original Honorary Members.

Dr. McDunnough was a Fellow of The Entomological Society of America and of The Royal Society of Canada. He was an Honorary Member of The New York Entomological Society as well as of The Lepidopterists' Society.

Throughout his later papers, published in *American Museum Novitates,* Dr. McDunnough was quite consistent in his reference to "the author's collection", an unfortunate phrase in one way, since it

has occasioned some misunderstanding about the disposition of this material. Sometimes he speaks both of "the author's collection" and "the Nova Scotia Museum collection", as he does in a single paragraph in a paper of 1956, "Microlepidoptera Notes and New Species" (*Amer. mus. novitates* 1789: 13), thus implying that he maintained a personal collection (containing his type material) separate from that of the museum. McDunnough actually kept the material on which he worked at Halifax fully integrated as one collection at all times, and never stated to me that he wished to see it arranged otherwise. His reference to "the author's collection" was a device to facilitate the transfer of any of the material to other collections if changing circumstances, such as the lack of a permanent curator, should make this seem advisable. All remaining holotypes and allotypes *were*, by our mutual agreement, removed and deposited in the Canadian National Collection at Ottawa in September, 1961.

After completing his *Hydriomena* revision, Dr. McDunnough worked entirely on microlepidoptera, collecting diligently and rearing fine series of many species. The microlepidoptera collection of the Nova Scotia Museum, as he left it, contains about 12,000 specimens of 1,000 species, and over 3,000 genitalia slides. About one-third of the specimens are the result of McDunnough's own collecting, and the remainder are from my collecting and from various other sources.

In the preparation of this biographical account, the sources of information were virtually limited to the few published sources acknowledged, and to my own recollections of many conversations with Dr. McDunnough. Perhaps the most valuable reference was the article by Mr. W. J. Brown, from which I have drawn freely. This is not readily available in most libraries. There is also a paper by J. D. Gunder (*Ent. news* 41: 179-182; 1930), which discusses some of the early work of McDunnough, and gives a portrait of him. *The Canadian Entomologist's* obituary and bibliography of McDunnough, by Dr. T. N. Freeman, was published just before the present paper went to the printer, and provided seven additional entries that I had overlooked. This brings the list of publications by Dr. McDunnough to a total of 313.

The photograph at the beginning of this obituary was taken by the writer at the Nova Scotia Museum in October 1959. The photograph on page 215 was loaned by Miss Grace McDunnough; it was undoubtedly taken during the period at Ottawa, perhaps in the early 1930's.

LIST OF PUBLISHED WORKS BY JAMES H. McDUNNOUGH

1909. Einige Bemerkungen zu *Parn. appolonius narynus* Fruhst. *Ent. Zeit.* Stuttgart 22: 179-181.

.... Über den Bau des Darms und seiner Anhänge von *Chrysopa perla* L. *Archiv für Naturgeschichte,* 75 Jahrg., Bd. I: 313-360, pls. 10-14.

.... Über den Bau des Darms und seiner Anhänge von *Chrysopa perla* L. Teil I, Larvæ. *Diss. Berlin* (E. Ebering): 1-48.

1910. [With Wm. Barnes] New species and varieties of North American Lepidoptera. *Can. ent.* 42: 208-213, 246-252.

.... [With Wm. Barnes] New species and varieties of North American Lepidoptera. *Journ. N. Y. ent. soc.* 18: 149-162.

.... [With Wm. Barnes] List of Sphingidæ of America North of Mexico. *Psyche* 17: 190-206.

.... [With Wm. Barnes] A new *Thecla* from Texas. *Can. ent.* 42: 365-366.

.... [With Wm. Barnes] Notes on life-history of *Anisota skinneri,* Bied. *Can. ent.* 42: 400-403.

.... [With Wm. Barnes] New North American Cossidæ. *Ent. news* 21: 463-466.

1911. [With Wm. Barnes] Concerning *Archylus tener* Druce (Lepid.). *Ent. news* 22: 265-266.

.... [With Wm. Barnes] Some remarks on *Mastor bellus* and *M. phylace* (Lepid.). *Ent. news* 22: 267-268.

.... [With Wm. Barnes] Additional new species of North American Lepidoptera. *Journ. N. Y. ent. soc.* 19: 82-85.

.... [With Wm. Barnes] On the nomenclature of the male genitalia in Lepidoptera. *Can. ent.* 43: 181-189.

.... [With Wm. Barnes] Notes on two species of *Apantesis. Can. ent.* 43: 257-259.

.... Peculiar habits of a hepialid moth. With some remarks on the synonymy of same. *Can. ent.* 43: 289-292.

.... [With Wm. Barnes] On *Cea immacula* and allied species. *Can. ent.* 43: 318-320.

.... [With Wm. Barnes] New species and genera of North American Lepidoptera. *Journ. N. Y. ent. soc.* 19: 151-162.

.... [With Wm. Barnes] On certain *Olene* species. *Psyche* 18: 157-159, pl.13.

.... [With Wm. Barnes] Revision of the Cossidæ of North America. *Contr. nat. hist. Lep. N. Am.* 1(1): 1-35, pls.1-7.

.... [With Wm. Barnes] The lasiocampid genus *Gloveria* and its allies. *Contr. nat. hist. Lep. N. Am.* 1(2): 1-17, pls.1-4.

1912. [With Wm. Barnes] Revision of the Megathymidæ. *Contr. nat. hist. Lep. N. Am.* 1(3): 1-43, pls.1-6.

.... [With Wm. Barnes] On the early stages of certain geometrid species. *Psyche* 19: 14-20.

.... [With Wm. Barnes] Further remarks on *Thecla clytie, leda* and *ines* (Lepid.). *Ent. news* 23: 49-53, pl.6, figs.1-7.

.... [With Wm. Barnes] On the spring and summer forms of *Sabulodes sulphurata* Pack. (Lepid.). *Ent. news* 23: 53-55, pl.6, figs.8-10.

.... [With Wm. Barnes] A new cossid (Lepid.). *Ent. news* 23: 55-56, pl.6, figs.11-12.

.... [With Wm. Barnes] New species and genera of North American Lepidoptera. *Can. ent.* 44: 17-22, 52-57, 90-93, 122-127.

.... [With Wm. Barnes] New microlepidoptera. *Ent. news* 23: 219-221.

.... [With Wm. Barnes] On the larval stages of certain arctian species. *Can. ent.* 44: 132-136, 188-191.

.... [With Wm. Barnes] *Basilarchia weidemeyerii angustifascia,* a new geographical race. *Can. ent.* 44: 163-164.

.... [With Wm. Barnes] Illustrations of rare and typical Lepidoptera. *Contr. nat. hist. Lep. N. Am.* 1(4): 1-57, pls.1-27.

.... [With Wm. Barnes] Fifty new species and varieties. *Contr. nat. hist. Lep. N. Am.* 1(5): 1-36.

.... [With Wm. Barnes] The genus *Alpheius* Rag. and its allies. *Contr. nat. hist. Lep. N. Am.* 1(5): 37-42.

.... [With Wm. Barnes] On the generic types of North American diurnal Lepidoptera. *Contr. nat. hist. Lep. N. Am.* 1(6): 1-13.

.... ~~[With Wm. Barnes] New noctuid species.~~ *Can. ent.* 44: 216-218.

.... [With Wm. Barnes] Notes on Taylor's types of Geometridæ. *Can. ent.* 44: 270-275.

1913. [With Wm. Barnes] On the early stages of some western *Catocala* species. *Psyche* 22: 188-202.

.... [With Wm. Barnes] Illustrations of rare and typical Lepidoptera (continued). *Contr. nat. hist. Lep. N. Am.* 2(1): 1-44, pls.1-21.

.... [With Wm. Barnes] The N. American species of the liparid genus *Olene. Contr. nat. hist. Lep. N. Am.* 2(2): 44-90, pls.1-7.

.... [With Wm. Barnes] New N. Am. Lepidoptera with notes on described species. *Contr. nat. hist. Lep. N. Am.* 2(3): 91-162, pls.1-9.

.... [With Wm. Barnes] Species of Lepidoptera new to our fauna, with synonymical notes. *Can. ent.* 45: 182-185.

.... [With Wm. Barnes] Some apparently new Lepidoptera from southern Florida. *Contr. nat. hist. Lep. N. Am.* 2(4): 163-194, pls.1-4.

.... Concerning the reputed disastrous occurrence of *Vanessa californica* in Oregon and California. *Can. ent.* 45: 233-235.

.... [With Wm. Barnes] A new pyromorphid from Texas. *Can. ent.* 45: 295.

.... [With Wm. Barnes] Some new North American Anaphorinæ. *Can. ent.* 45: 419-421, pl.16.

1914. [With Wm. Barnes] On the synonymy of certain Florida Lepidoptera. *Can. Ent.* 46: 27-31.

.... [With Wm. Barnes] Synonymic notes on North American Lepidoptera. *Contr. nat. hist. Lep. N. Am.* 2(5): 195-223.

.... [With Wm. Barnes] Some new North American Pyraustinæ. *Contr. nat. hist. Lep. N. Am.* 2(6): 224-250, pls.1-2.

.... [With Wm. Barnes] A note on *Argynnis laurenti* Skinner (Lepid.). *Ent. news* 25: 323-324.

.... Notes on the synonymy of Boisduval's N. American species of Lycænidæ. *Ent. record* 26: 194-203.

1915. [With Wm. Barnes] A new genus and a new species of Lepidoptera from Arizona. *Can. ent.* 47: 20-22.

.... [With Wm. Barnes] On the early stages of two moths. *Can. ent* 47: 271-276.

.... [With Wm. Barnes] Notes on some recently described species of North American Lepidoptera. *Can. ent.* 47: 282-284.

.... Synonymical notes (Lep.). *Ent. news* 26: 471.

1916. Notes on types of Lepidoptera in Snow Collection. *Can. ent.* 48: 25-28.

.... [With Wm. Barnes] An apparently new species of *Phalonia. Can. ent.* 48: 144.

.... [With Wm. Barnes] Some new races and species of North American Lepidoptera. *Can ent.* 48: 221-226.

.... [With Wm. Barnes] A new noctuid genus. *Can. ent.* 48: 290-291.

.... On the types of certain noctuid genera occurring in North America (Lepid.). *Ent. news* 27: 393-400.

.... [With Wm. Barnes] New species of North American Lepidoptera. *Contr. nat. hist. Lep. N. Am.* 3: 1-34, pls.1-3.

.... [With Wm. Barnes] Notes on Walker's types of Geometridæ in the D'Urban Collection. *Contr. nat. hist. Lep. N. Am.* 3: 35-42.

.... [With Wm. Barnes] Notes on North American diurnal Lepidoptera. *Contr. nat. hist. Lep .N. Am.* 3: 49-152, pls.4-11.

.... [With Wm. Barnes] Synonymic notes on North American Heterocera. *Contr. nat. hist. Lep. N. Am.* 3: 153-208, pl. 12-15.

1917. [With Wm. Barnes] *Check list of the Lepidoptera of Boreal America.* Published by the authors; Decatur, Ill.; Feb. 1917.

.... [With Wm. Barnes] Further notes on *Philotes battoides* and its allies. *Contr. nat. hist. Lep. N. Am.* 3: 213-216, pls.16-17.

.... [With Wm. Barnes] A few remarks on Grossbeck's list of Florida Lepidoptera with descriptions of new species. *Contr. nat. hist. Lep. N. Am.* 3: 217-223, pl.18.

.... [With Wm. Barnes] New species and varieties of Geomeetridæ. *Contr. nat. hist. Lep. N. Am.* 3: 224-296, pls.19-33.

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.... The nymph of *Cinygma integrum* and description of a new heptagenine genus. *Can. ent.* 65: 73-76.
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A MIGRATION PROBLEM – *VANESSA CARDUI* (NYMPHALIDÆ), THE PAINTED LADY BUTTERFLY

by CHARLES H. ABBOTT

The subject of insect migration, and particularly of butterfly migration, has reached the point where certain laws of migration are beginning to emerge. We are also learning that exact information is lacking on many points which we have taken for granted, and that when we secure this information we shall be in a better position to formulate laws.

As a first basis we must admit, as WILLIAMS (1958) has so many times pointed out, we cannot arbitrarily divide migration into rhythmic migration and one-way migration (also called emigration or, better, unidirectional migration with no return). Only one butterfly, the Monarch, *Danaus plexippus* (L.) is usually considered to have a typical rhythmic migration, in which the same individuals make a two-way flight; while WILLIAMS has collected data showing return flights by successive generations in an increasing number of species. Therefore, if two-way and one-way insect migrations are essentially different, we do not have enough knowledge to divide the butterflies between them. Our problem is to find some underlying principles or laws, and there will be time enough to determine how wide can be their application.

As has been previously pointed out, the Painted Lady, *Vanessa cardui* (Linnæus) was selected for this study, because in migration years it is so abundant that there is limitless material on which to work, and because its study has been neglected. The conclusions to date may be found in the author's 1950, 1951, and 1959 papers, and may be very briefly summarized as follows:

The species is usually found, so far as North America is concerned, only south of the United States, or possibly, in southernmost Imperial Valley; and comes north only in migration years, which are few in number and at irregular intervals (with possible minor exceptions to be noted later). If one could observe the start of a migration at the point of origin, probably large numbers would be noted all at once, but at points in California very small numbers appear at first with a gradual build-up.

The direction of migration is consistent, year after year, in most California localities toward the north-northwest. The geographical extent of the migration in any one year appears correlated with the numbers involved, the larger the numbers the greater the distance covered by the species. It was determined in 1958, when the migration was traced eventu-

ally from the Mexican border to the Cascades of Washington, that several generations were involved, probably four in California, and the number farther north undetermined. This makes one wonder if each generation found an optimum of conditions in the area which it reached and where it laid eggs, and that such a combination of optima over the entire Pacific Coast area rarely occurs.

I believe we have already the most complete picture available (of course far from complete) of the migration of a single North American butterfly, except probably the Monarch (*Danaus plexippus*); and from what WILLIAMS says in his latest book *Insect Migration* (1958), I do not believe as complete a picture is available of any species in Europe.

What I want to outline now is particular observations which are needed to fill in gaps in our knowledge, which are practicable for field lepidopterists. As a reason for doing it, I want to quote a paragraph from page 2 of WILLIAMS's *Insect Migration* (1958): "We can ask for example why Painted Ladies migrate; this is a problem of the origin and evolution of the habit. But we have also to consider the much more detailed problem of how or why a particular individual butterfly is migrating in a particular direction at a particular time. In my opinion it is by finding answers to the second that we may be able to solve the first of these questions."

1. What is the distribution of this species in western North America in a non-migration year? WILLIAMS (1938, 1958) has reported, on the basis of published reports from this part of the country, that the species is found north of Mexico only in years of extensive migrations. There seems to be little doubt that the source of our great migrations is south of the Mexican border (Abbott, 1959), although little is known of the exact location or nature of the breeding grounds. One in Baja California, discovered by GARTH and DAWSON in 1949, has been described (Abbott, 1951: p.159).

The above statement appears to be open to exceptions, as there are several unpublished reports by competent lepidopterists of small resident populations in California and Nevada which have been observed year after year. There is a difference of opinion whether these populations take part in a general migration. It is important that information on these resident populations should be published, particularly as to the number of generations per year, the length of each stage of metamorphosis, and what stage is inactive in a carry-over from one year to the next.

As a possible explanation of this last paragraph, it was suggested by P. F. BELLINGER (personal communication) that *V. cardui* might have

phases such as those described for locusts, a migratory phase, associated with overcrowding, and a non-migratory phase, called solitary in locusts. (For discussion of UVAROV's Phase Theory, see Williams, 1958: pp.158-161. This discussion also reports similar phases in certain moths.)

It seems to be more difficult to determine if there is an inactive period in the annual life history of the species in its home in Mexico whence the migrations periodically come. The key point which needs to be determined, and is also the most difficult to find out, is what combination of conditions starts a species migrating. Is it a set of conditions which work directly on the adult insect, or is it a combination of favorable conditions resulting in a larger number of eggs laid, a larger number of larvæ developing to the pupa stage, or a larger number of pupæ surviving to emerge as adults?

2. The only known set of external conditions which appears to favor a very large generation of *V. cardui* in the desert or semi-desert south of the border is the right combination of rains and temperature to give an unusual crop of desert vegetation, chiefly annual wild flowers. This serves as food for the larvæ, and could result in the next generation of egg-laying and potentially migrating adults being much larger. This makes extremely important the recording of all possible data on rainfall, temperature, and vegetation in subsequent migration years; also facing the fact of the great variation in conditions in different parts of the desert. The past data on this point are rather scarce and inconclusive. The question which needs to be answered is: Is a heavy migration *always* correlated with heavy winter rains in the desert at the right season to produce a large crop of desert annual wild flowers?

Data available at present make a "yes" answer to this question doubtful, but the data are inconclusive (Abbott, 1951: p.162.) If this is a correct conclusion, it is probable that large crops of annuals at points somewhat farther north from the Mexican border would help to explain the very large second and third generations such as were noted in 1958.

But what determines the large first generation in a migration year? Is it a combination of conditions having a sudden effect on some stage of development? Or does a migration result only when there has been cumulative build-up of numbers during preceding generations, perhaps since the last preceding migration?

3. An alternative theory, which deserves investigation, is that the instinct to migrate is always present in this species or at least in the migratory phase of this species. In non-migration years they are too few and fly too short distances to be observed by any except trained

observers who happen to be in exactly the right localities. This would explain the report by R. C. DICKSON that a small migration occurs in Imperial Valley every year. The following is a suggested pattern for a non-migration year.

At the beginning of the season only a small number of imagoes transform from pupæ, and being few in number they do not have to fly far to find vegetation on which to lay eggs; or, owing to a very short growing season of plants, only a very small number of eggs from the last preceding generation develop as far as adults of the first generation of the new season. Parasites in the usual numbers would also be more effective in controlling a small generation. Predators are usually at least one generation behind their prey in a fluctuation in numbers (Elton, 1927: p.141), and this may be true of the so-called parasitic Hymenoptera and Diptera, which are really midway between predators and parasites.

If the instinct to migrate is always present, it would explain why in a migration year the succeeding generations, even if many miles from the base habitat and perhaps from the original cause, continue to migrate until adverse conditions stop the migration.

4. How long do female *V. cardui* live after egg-laying, and do the individuals continue migrating after egg-laying? Do males migrate the same distance as females?

5. Is the migration of a particular season stopped by any or all of the following?

a. Egg-laying, causing adults to stop flying.

b. Failure of new generation to develop in egg, larval, or pupal stage. Might be in larval stage, due to drying up of food plant, or in any stage, due to parasitism. We also do not know if unfavorable weather conditions may have a direct effect on any stage.

c. If the adults have died after egg-laying and the next generation has failed to develop, it would explain why there is no over-wintering in the regions reached by migration, or no return flight, if there is any instinct for return flight.

d. If there is ever any evidence discovered for over-wintering following migration, in a locality where this species is normally absent, it should be reported immediately. It is even more important to report any evidence for a return flight to the south. In the case of the Africa — Europe flyway of the same species, WILLIAMS (1958) has found no evidence of over-wintering in the north, but several instances of southward flight in autumn. Of course these were not the same individuals which flew north, but a subsequent generation.

6. Is there any authentic evidence in the Pacific states for the migration of any other species of *Vanessa* often associated with *V. cardui,* or closely resembling it? I refer, particularly, to *V. carye, V. virginiensis,* and *V. atalanta.* I have found *V. carye* and *V. atalanta* feeding on the same bush with migratory *V. cardui,* but have never seen either species fly away from a bush and join a migratory swarm. Occasionally I have seen a single *V. atalanta* flying with migratory *V. cardui. V. carye* are not easily distinguished in flight.

V. carye is regularly described as resident and non-migratory. Williams, *et al.* (1942) give two reports each for migrations of *V. virginiensis* and *V. atalanta* in the eastern United States.

This paper is based on one presented before the Pacific Slope Section of the Lepidopterists' Society at Santa Barbara, California, August 26, 1961. It has outlined points on which exact information would be of help in interpreting the migration of *Vanessa cardui,* the Painted Lady Butterfly, and perhaps of Lepidoptera in general. Its purpose is a request for information. If any observers of the migration of this species have any past data on these points or acquire any in the near future which they do not wish to publish separately, it would greatly assist the writer if they would send them to him.

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OCHLODES SNOWI AT BLACKLIGHT IN COLORADO (HESPERIIDÆ)

by Thomas C. Emmel

Records of butterfly species flying at night or being attracted to lights at night are rare, due mostly, of course, to the normal diurnal flight habits of these insects and inactivity in the absence of a minimum level of solar radiation (Hovanitz, 1948; Emmel & Emmel, in press). Nevertheless, a number of Rhopalocera species are reported in the literature visiting blacklight (ultraviolet), incandescent light, and lighthouse beacons.

A new species record was obtained by the author in the summer of 1960 at Big Spring Ranch, 8640 feet elevation, near Florissant, Teller County, Colorado. Four fresh specimens of *Ochlodes snowi* Edwards were taken on the nights of July 20, 21, and 23. The two individuals taken on the twenty-first of the month flew in to a moth sheet which had as a light source a single General Electric 15-watt Black Light (unfiltered) Lamp. The single specimens collected on the twentieth and twenty-third were resting around an ordinary 150-watt incandescent lamp. All four individuals were obtained in the early morning (before 5 a.m.); the temperature ranged from about 65° to 60°F between midnight and 5 a.m., with no wind, cloudiness or moonlight (new moon) occurring. According to Brown, Eff and Rotger (1957) this skipper is found rather generally in the mountains "from 7,000 to 9,000 feet above sea level in open fields and along the roadsides;" its foodplant and life history are unknown. From the fresh condition of the individuals and their quiet resting around the lamps, it appeared that these skippers were freshly emerged. Since the moth-collecting lights were directed toward a large dry meadow area, it is possible they came from their chrysalides only a short distance away. Interestingly enough, except for these specimens at light this species was never found in the Ranch area during the entire summer despite rather intensive day-collecting.

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INTER-SPECIFIC PAIRING IN LYCÆNIDÆ

by JOHN C. DOWNEY

Only two inter-specific pairings involving North American Lycænidæ are known to me. These are:

Callophrys dumetorum (Bdv.) ♂ × *C. augustinus iroides* (Bdv.) ♀, reported by WRIGHT (1906);

Lycæna thoe Guérin ♂ × *L. phlæas americana* Harris ♀, noted by SICHER (1953).

It was therefore rather surprising to find two unpublished examples of inter-specific pairing in a recent examination of Lycænidæ in eastern museums. These unusual combinations are as follows:

Lycaena cupreus snowi Edw. ♀ × *Chlosyne* c. f. *acastus* (Edw.) ♂ (Nymphalidæ), at the Carnegie Museum;

Plebejus (*Icaricia*) *icarioides* (Bdv.) ♂ × *Plebejus* (*Lycæides*) *melissa* (Edw.) ♀, at the American Museum of Natural History.

Mr. HARRY K. CLENCH called my attention to the first pairing, which specimens were in the W. H. Edwards collection. No locality data accompanied the specimens which were mounted on a single pin, but they were labeled "*in copula*" in EDWARDS' handwriting. The *P. icarioides* - *melissa* specimens were captured *in copula* in flight at Porcupine Basin, Wind River Range, Sublette Co., Wyoming, August 9, 1953, by Dr. F. H. RINDGE. This pairing is of somewhat more than casual interest for several reasons. NABOKOV (1949) considers his subspecies *Plebejus* (*Lycæides*) *argyrognomon longinus* to be somewhat intermediate between the nominate *argyrognomon* and *P. melissa melissa* (Edw.).

Although both species are sympatric throughout much of their range, only in the Teton Mountains, Wyoming has NABOKOV (*loc. cit.*) noted morphological transitions. He further selected the holotype male of *longinus* from Jackson Hole, Wyoming, even though the specimen was somewhat battered, because of its being taken *in copula* with the allotype "... thus leaving no doubt as to their being conspecific" (*loc. cit.*, p.516). I concur with NABOKOV in this decision and the taxonomic usefulness of mated pairs. In fact, in some Lycænidæ showing marked sexual dimorphism, *i.e. Epitola*, only by catching the species *in copula* can the

sexes be properly associated (see Roche, 1954). Inter-specific coupling seems to be sufficiently rare that this use is justified; however, a degree of caution would seem warranted in certain cases and areas. For instance, although the Wind River specimens above offer meager evidence of "behavioral integradation' for at least one of the species involved (*melissa*), the addition of this notation to Nabokov's morphological intermediates involving the same species in relatively the same region suggests that mating patterns may not be equally fixed throughout the range of a species. *P. melissa* in western Wyoming may prove to have fewer inter-specific mating barriers than in other geographical areas.

It should be noted that the above "pairings" need not and, in fact, probably would not, result in fertilized eggs. Attempts at inter-specific (and even inter-generic) matings are often noted in other insect groups, for example, the beetles. Within the Lepidoptera, numbers of unusual pairings have been reported in the moths (e. g., Akester, 1956; Demuth, 1956; Fischer, 1949; Owen, 1952), and in the butterflies, cases within the genus *Colias* are well known. Watkins (1954) has reported a suspected hybrid between the European lycænids *Polyommatus icarus* Rott. and *Lysandra coridon* Poda. Wright (*loc. cit.*) made some attempt to derive data on frequency of "mis-matings" by comparing the number noted versus an estimated total number of pairings observed over a seven year period. His figures indicated 1 out of 70 (*not* 1 out of 140 as given *loc. cit.*, p.22) pairings observed were inter-specific. Although his method was very subjective, together with the rather numerous subsequent reports from the literature, it is suggested that inter-specific coupling in the Lepidoptera is much more common than might be otherwise supposed.

It may be more significant, however, that cross-matings seem, in general, not even to be attempted. Some of the reasons for this may be involved in size, behavioral characteristics, time of flight, time of maximum activity, seasonal cycles, and micro-ecological niches. This information is lacking for most of the Lycænidæ and yet, if as many as seven species, as reported above, occasionally couple with other species, perhaps the answer to inter-specific pairing and the infrequency of its occurrance is within easy reach. It is suggested that lepidopterists, both amateur and professional, can make valuable contributions to this subject by maintaining accurate records of their field observations and publishing them when sufficiently significant.

Grateful acknowledgment is hereby made to the National Science Foundation, Grant No. G-9024, which is supporting a major project on variation in the Lycænidæ.

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PARASITINSEKTEN DER BLATTMINIERER EUROPAS. By L. Fulmek. 203 pp. 1962. Publisher: W. Junk, Den Haag, Netherlands. [Bound; price Dutch Guilders 28.00].

The author arrived at the good idea of publishing a book on the insect parasites of leaf miners, as an addition to the monumental work of E. M. Hering *Bestimmungstabellen der Blattminen von Europa* (see review in *Lepid. news* 11: 177-178; 1957). In its main part (145 pages) the new book represents an annotated check list of 680 host species, all of them being leaf miners recorded in Europe. Among them 415 species are Lepidoptera, 213 Diptera, 35 Coleoptera, and 17 Hymenoptera. This comprises about 34% of the entire total of leaf miners (over 2000 species) treated by Hering in his book. The number of host species reviewed by Fulmek in his present book must be recognized as rather high, taking into consideration the fact that insect parasites are known so far in only about 10% of all described insect species.

In the check list the host species are arranged alphabetically, by orders and genera. In each order the lists of hosts are preceded by a summary of the systematic distribution of the genera among the families and concluded by some statistical data on the parasites. The annotations to

each host species are limited to the basic synonymy (when necessary) and lists of parasitic species with geographic data, occasionally with reference to the recording authors. An alphabetical index of over 1200 parasites (21 pages of the book) refers to the above check list of the hosts. Preface, introduction, discussion, and summary are briefly composed and, together with the short lists of the basic literature and abbreviations, make up the remaining pages of the book, the main purpose of which is to awaken in the students of leaf miners an interest in the parasites of this group of insects.

Among the European leaf miners, 55 parasitic insects are known in the Hymenoptera, 169 in Coleoptera, 385 in Diptera, and 520 in Lepidoptera. Most of the parasites (99.4%) belong to the Hymenoptera families Braconidæ, Chalcididæ, Cynipidæ, Ichneumonidæ, Proctotrupidæ, and some Vespoidea; only some few (0.6%) to the Diptera. Especially "record-breaking" in the number of parasites are the Lepidoptera species *Coleophora laricella* Hb. and *Tischeria ekebladella* Bjk., each of them having 42 parasitic species.

The style in which the book is written is very concise but nevertheless quite understandable. The author may only be accused of inconsistency of the language used in the locality names which are either done in Latin (Austria; Germ = Germania, Germany; Suec = Suecia, Sweden; Gall = Gallia, France; etc.) or in German (Ungarn = Hungary; Russl = Russland, Russia; Polen = Poland; etc.), or even in a mixture of these two languages (WGall = "West" Gallia, western France; SGall = "Süd" Gallia, south France). No explanations for the abbreviated locality names are given. Upper Bavaria is indicated now as "ObBayern" (Oberbayern), now as "SBayern" (Südbayern). The editorial defects consist of the use of the same roman characters for the names of insects and plants, authors' names, and the locality data. The chapters are not always distinctly separated in the text; their titles are at times completely omitted, or do not correspond to those in the table of contents. All these defects need to be corrected in a second edition, in case this will be published.

In its gold stamped linen cloth cover, the book has a very pleasant appearance; the paper is good, the type is clear. The price (about $7.80) cannot be regarded as very high for a book of this kind. The book will undoubtedly be approved by the leaf miner students, for whom it is intended.

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THE VARIATION OF *POLITES DRACO* (HESPERIIDÆ) WITH ALTITUDE

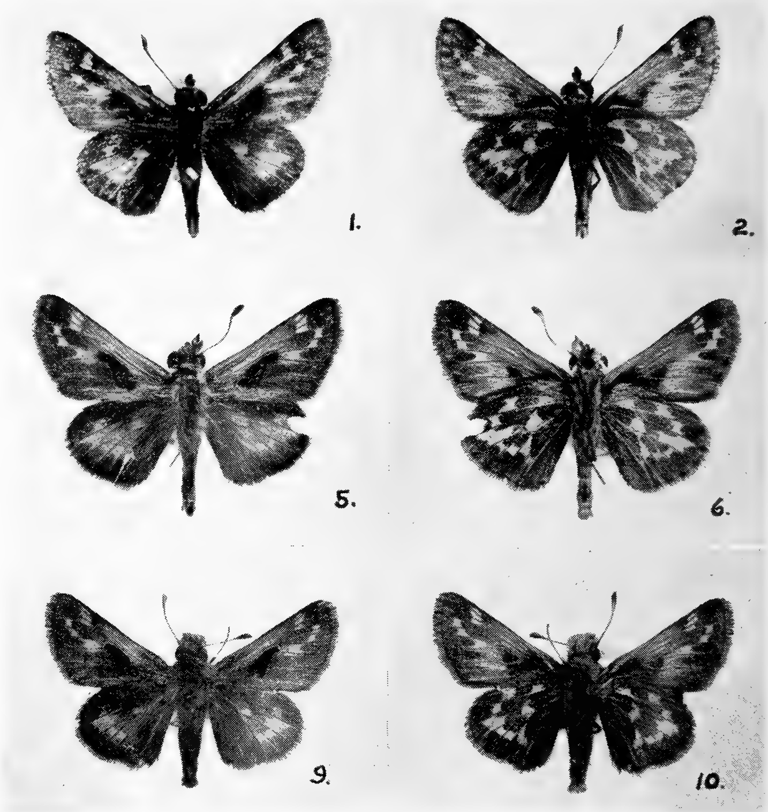
by F. Martin Brown

While collecting in the vicinity of Ouray, Colorado, in 1960, I was struck by the large size and the light coloration on the under side of the *Polites draco* that I was getting at little more than 7,000 feet above sea level. This is about as low altitude as the species inhabits in Colorado. It ranges upward from there to the grasslands above timberline, almost reaching 13,000 feet above sea level.

Edwards (1871) described the butterfly from material that had been collected in that year by Theodore L. Mead, his future son-in-law. In the original description Edwards credited Mead with the capture of the types and gave the type locality as "Colorado." Mead (1875: p.790) wrote of *draco*: "Specimens were brought by the expedition from Southern Utah, and from Twin Lakes, Colorado. It is also found in California." This situation led Brown (1935: p.162) to suggest that Twin Lakes, Colorado, be considered the type locality of the species. Mead was at Twin Lakes from July 9, 1871, to around the 17th of the month (Brown 1956: p.189). This is just the time of the year at which to get the species at Twin Lakes, which is situated about 9,500 feet above sea level. It is very near to the midpoint of the altitudinal range of *draco* in Colorado.

Edwards' description of *draco* fits very well what I choose to call the "low altitude" or light form of the species. Holland's figures of the types (1931: pl.53, fig.15, 16) compare favorably with material from the 9,000 to 10,000 feet elevation zone within which Twin Lakes is situated. Fresh specimens are a little greyer or greener than the reproduction in my copy of *The Butterfly Book* suggests.

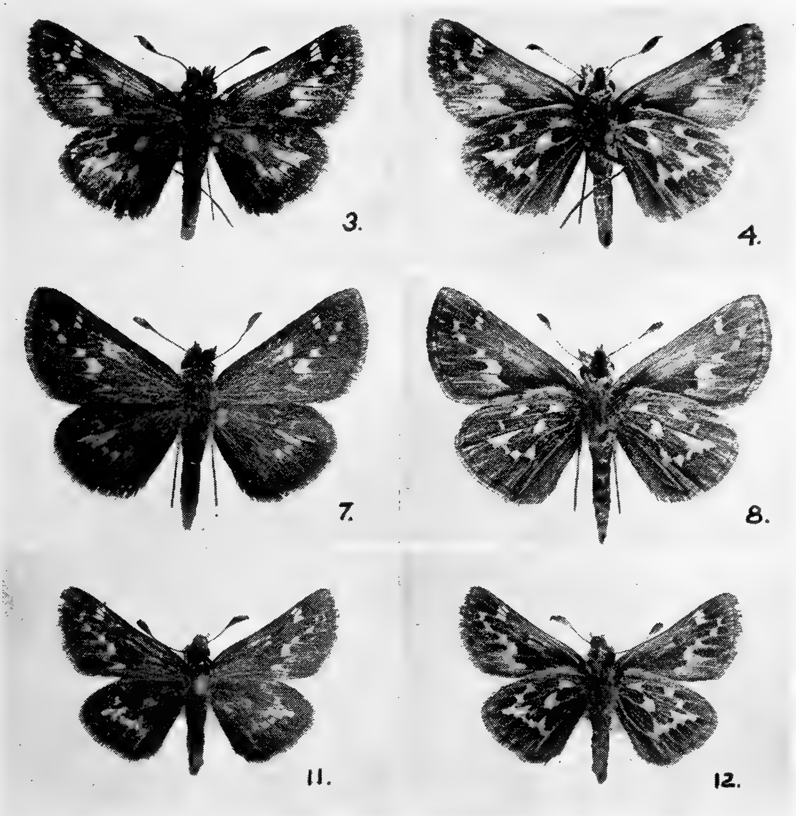
These are the systematic variations that occur with altitude in *draco*: 1) the length of the costal margin of the fore wing decreases with increase in altitude; 2) the area covered with fulvous scales on the upper side of the wings decreases with increased altitude and, concommitantly, the fuscous margins become wider; 3) the maculation on the upper side of the hind wings of the females becomes more sharply defined and the individual marks become smaller with increase in altitude; 4) on the under side of the hind wings the marks become smaller and more sharply defined with increase in altitude; 5) the ground color of the under side of the hind wings and the outer marginal area on the fore wings becomes



Polites draco ♂♂, all COLORADO: 1 & 2) low altitude form, Ouray, Ouray Co., 7,800′, 28 June 1960; 5 & 6) type altitude form, Canyon Creek, Ouray Co., 9,000′, 20 June 1960; 9 & 10) high altitude form, Glen Cove, Pikes Peak, Teller Co., 12,000′, 15 July 1932. (Uppersides left, undersides right.) × 1.5.

less greyed and more nearly chocolate brown with increase in altitude; 6) light lunular smudges, often violet grey in color, along the outer margin of the under side of the hind wings, especially clear on females, found on low altitude specimens disappear with increased altitude.

The two ends of the cline of variation are abundantly distinct. However, intergradation from one to the other is so complete on the slopes of a single mountain that naming them would be unwise. The changes evidently are a response to environmental conditions imposed by changes in altitude. In Colorado there is a regular increase in moisture accompanying the usual decrease in temperature as you ascend a mountain.



Polites draco ♀♀, all COLORADO: 3 & 4) same data as figs. 1 & 2; 7 & 8) same data as 5 & 6; 11 & 12) Buckskin Joe Gulch, Park Co., 12,000′, 5 August 1949. (Uppersides left, undersides right.) × 1.5.

It is possible that the decrease in oxygen tension may have something to do with the metabolic changes that bring about the darker coloring that increases with altitude. It also is possible that the shorter growing season at high altitude reduces nutrition of the growing caterpillars and thus produces smaller imagoes.

Long and short series of *Polites draco* from forty-three localities in Colorado were examined for this brief study. They are distributed among fifteen of the mountainous counties in the State. The distribution of the localities sampled may be summarized:

Altitude range	*Number*	*Counties*
12,000 ft. upward	7	Park, Summit, Teller, Pitkin
11,000 - 12,000 ft.	10	Park, San Juan, Lake, Saguache, Eagle, Pitkin, Boulder
10,000 - 11,000 ft.	9	Park, LaPlata, Saguache, Mineral, Lake, Clear Greek, Pitkin
9,000 - 10,000 ft.	11	Park, Clear Creek, Teller, El Paso, Grand, Gilpin, Ouray, Lake
8,000 - 9,000 ft.	6	Park, Pitkin, Grand, Ouray
7,000 - 8,000 ft.	1	Ouray

The dates upon which the collections were made become later in the summer as altitude increases:

Altitude	*Range of dates*
12,000 ft. upward	15 July to 20 August
11,000 - 12,000 ft.	4 July to 19 August
10,000 - 11,000 ft.	28 June to 5 August
9,000 - 10,000 ft.	21 June to 27 July
8,000 - 9,000 ft.	25 June to 13 July
7,000 - 8,000 ft.	12 June to 29 June

It would be interesting to learn through breeding experiments how much of the variation found in *Polites draco* is genetic and how much a somatic response to the environmental factors that accompany increase in altitude.

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FIRST ADDITIONS TO THE NORTHERN ONTARIO LIST OF BUTTERFLIES

by J. C. E. Riotte

A. Additional Species, etc.

Strymon falacer Godt.: Sudbury (1959) – July m.
Colias gigantea Stkr.: Cape Henrietta Maria, Fort Albany, Fort Severn – July m.
Adopœa lineola Ochs.: Sudbury (1960/61) – July m.
Poanes hobomok f. "pocahontas" Scud.: Sudbury (1961) – June m.
Atrytone bimacula G. & R.: Sudbury (1959) – July b.

B. Additional Localities

Lethe eurydice Joh.: Geraldton.
Lethe portlandia borealis A. H. Clark: One Sided Lake, S. Neeling twsp.
Euptychia cymela Cramer: One Sided Lake.
Cœnonympha tullia inornata Edw.: Sudbury.
Cercyonis pegala nephele Kby.: One Sided Lake, Wabigoon.
Oeneis macounii Edw.: Hymers.
Oeneis jutta ridingiana Cherm. & Cherm.: Nakina.
Erebia disa mancina Westw.: Hymers.
Danaus plexippus L. Sudbury.
Speyeria atlantis Edw.: Charlton, Dinorwic, Hearst, Inwood Park, Kapuskasing, Kenora, Lake of the Woods, Poland, Savanne, Sudbury, One Sided Lake, White River.
Speyeria cybele Fabr.: S. Neeling twsp., Sudbury.
Speyeria aphrodite winni Gund.: Inwood Park, Kapuskasing.
Boloria selene atrocostalis Huard: Borup's Corners, Charlton, Hymers, Inwood Park, Kenora, Poland, Savanne, Vermilion Bay, One Sided Lake, Wabigoon.
Boloria eunomia dawsoni B. & McD.: Nakina.
Boloria titania grandis B. & McD.: Oog Lake, Sudbury Distr.
Boloria freija Thunbg.: Hymers.
Boloria toddi toddi Holl.: Borup's Corners, Charlton, Dinorwic, Gold Rock, Hymers, Inwood Park, Poland, Savanne, Vermilion Bay, One Sided Lake, S. Neeling twsp., Wabigoon.
Boloria frigga Thunbg.: James Bay, Nakina.

Melitæa harrisii Scud.: S. Neeling twsp., Sudbury (re-taken 1960).

Melitæa nycteis drusius Edw.: Charlton, Hymers, One Sided Lake, S. Neeling twsp.

Phyciodes tharos Drury: Charlton, Dinorwic, Inwood Park, Wolf River, One Sided Lake, S. Neeling twsp.

Polygonia satyrus marsyas Edw.: One Sided Lake, Vermilion Bay; recent re-evaluation of the material available from northern Ontario proved that this material does not belong to the typical race but to the race *marsyas.*

Polygonia faunus Edw.: English River, Savanne, Upsala, Vermilion Bay.

Polygonia progne Cram.: English River, Inwood Park, Savanne, Vermillion Lake (Sudbury), One Sided Lake.

Nymphalis j-album Boisd. & Lec.: Charlton, 65 mls. W. of Hearst, One Sided Lake, S. Neeling twsp.

Nymphalis milberti L.: One Sided Lake, Poland, Raith.

Nymphalis antiopa L.: 65 mls. W. and 35 mls. E. of Hearst, Inwood Park, Lake of the Woods, One Sided Lake, S. Neeling twsp., Upsala.

Vanessa virginiensis Drury: Charlton, Inwood Park, Kenora, Poland, One Sided Lake, Wabigoon.

Vanessa atalanta L.: One Sided Lake.

Limenitis archippus Cram.: Sudbury.

Limenitis arthemis Drury: Charlton, One Sided Lake, S. Neeling twsp.

Strymon acadica f. "muskoka" Wats. & Comst.: Sudbury.

Strymon liparops fletcheri Mich.: Inwood Park, One Sided Lake.

Incisalia niphon clarki T. N. Freem.: Sudbury.

Feniseca tarquinius Fabr.: One Sided Lake, Sudbury (re-taken 1960).

Lycæna thoë Guér.: One Sided Lake, Poland.

Lycæna epixanthe michiganensis Rawson: should be changed to next.

Lycæna epixanthe amicetus Scud.: localities as listed under *michiganensis.*

Lycæna helloides Boisd.: Hymers, One Sided Lake, Sudbury (1 ♀ VII-5-1960).

Lycæna dorcas Kby.: Hymers.

Plebeius sæpiolus Boisd.: Fort William.

Glaucopsyche lygdamus couperi Grote: Fort William.

Lycænopsis argiolus pseudargiolus Boisd. & Lec.: S. Neeling twsp.

Everes amyntula Boisd.: English River, Fort William, One Sided Lake, Raith, Vermilion Bay.

Papilio glaucus canadensis R. & J.: Charlton, Fort William, S. Neeling twsp.

Euchloe ausonides mayi Cherm.: S. Neeling twsp.

Colias eurytheme Boisd.: Inwood Park, Kenora, Lake of the Woods, One Sided Lake, S. Neeling twsp., Sudbury, Vermilion Bay.

Colias philodice Latr.: Charlton, Inwood Park, Raith.

Colias interior Scud.: Cartier, Charlton, 65 mls. W. of Hearst, Ignace, Inwood Park, One Sided Lake, White River. Delete Fort Albany, Fort Severn.

Colias pelidne Boisd. & Lec.: Fort Albany.

Pieris rapæ L.: Inwood Park, One Sided Lake, S. Neeling twsp., Sudbury.

Pieris napi oleracea Harris: Charlton, One Sided Lake, S. Neeling twsp., Sudbury, Wabigoon.

Thorybes pylades Scud.: One Sided Lake.

Erynnis icelus Scud. & Burg.: S. Neeling twsp.

Carterocephalus palemon mesapano Scud.: One Sided Lake.

Ancyloxipha numitor Fabr.: One Sided Lake, Sudbury.

Hesperia laurentina Lyman: Charlton, Dinorwic, Inwood Park, Nakina, Poland, Savanne, Wabigoon.

Polites themistocles Latr.: One Sided Lake, Upsala.

Polites peckius Kby.: One Sided Lake, S. Neeling twsp., Poland, Raith.

Polites mystic Scud.: Geraldton, Nakina, One Sided Lake, S. Neeling twsp., Port Arthur.

Poanes hobomok ridingsi Cherm. & Cherm.: Charlton, One Sided Lake, S. Neeling twsp.

Atrytone ruricola metacomet Har.: One Sided Lake.

Amblyscirtes vialis Edw.: One Sided Lake.

In the above records are included those of the Lyman Collection in Macdonald College, Ste. Anne de Bellevue, P. Q., which previously were not yet available.

Reference

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A NEW *EUREMA* RECORD FOR SOUTHERN FLORIDA

I was fortunate in taking a specimen of *Eurema dina* subspecies *helios* M. Bates, on August 23, 1962, at Fairchild Gardens, Matheson Hammock, Dade County, Florida.

Dr. A. B. Klots, who kindly made the determination, stated it was the first record of its appearance in Florida, or for that matter, as far as he knew, in the United States.

The specimen will remain in the collection of the Museum of Natural History, New York, to authenticate the record.

John M. Plomley, 7731 N. W. 8th St., West Hollywood, Fla., U. S. A.

BURDICK COLLECTION TO UNIVERSITY OF COLORADO

The University of Colorado Museum, Boulder, Colorado, has recently received a large collection of North American butterflies from the estate of William Nelson Burdick of Los Angeles, California.

The collection numbers over 20,000 specimens, of which over 7,000 are identified and prepared in such a manner as to be immediately useful for consultation, teaching and research. Over 12,000 specimens are largely duplicates which are available for exchange with other institutions and collectors. Some 1,000 specimens represent other orders of insects than butterflies, especially representative being the robber flies, in which Mr. Burdick took special interest.

William Nelson Burdick was born in Denver in 1887, the son of Dr. William Nelson Burdick, Sr., who was a well-known physician in Denver and Leadville. William N. Burdick, Jr., graduated from the University of California, majoring in Entomology, which he pursued as an avocation throughout his life. He was the author of numerous scientific papers on the subject of North American butterflies, and his bequest to the University of Colorado includes a number of unpublished manuscripts.

He is survived by his widow, Mrs. Sheila Burdick of Los Angeles.

PRESIDENTIAL ADDRESS TO THE TWELFTH ANNUAL MEETING OF THE LEPIDOPTERISTS' SOCIETY

This meeting marks the second occasion in which the Lepidopterists' Society has scheduled its national gathering in the state which contains a greater number of its own members than any other state in the Union.

This prompts us to express our gratitude to the Executive Council and Officers for the privilege of attending a foregathering of our confrères without the long trek to some distant area.

It also gives us the opportunity of expressing to the Officers and Director of the Santa Barbara Museum of Natural History our deep appreciation of the many courtesies they have extended to our organization and its members on this and many other occasions.

The particular message that I wish to present at this time concerns one aspect of our entomological endeavors which, I believe, is of major importance, namely, the relationship of graphic illustration to publication of technical papers.

The ancient Chinese proverb that "a picture is worth ten thousand words" is as true today as it was in olden times. We must also stress the point that scientific illustrations should evidence the same degree of accuracy and craftsmanship as is expected in the written text.

The late JOHN L. RIDGEWAY, in his excellent book, *Scientific Illustration* (published by Stanford University), puts it aptly as follows: "in the matter of illustrations, which are an important corollary to the literature of science, their very character, purpose, and treatment place them in a class quite distinct from the more popular application of the art."

We agree with RIDGEWAY also that a scientific illustrator "does not recognize modernistic tendencies in the display and technique of scientific illustration."

In this exacting craft there is no place for the type of individualistic "masterpiece" suggesting scrambled eggs on burlap, framed and hung (frequently upside-down) in museums, with high-sounding titles and higher prices. Fortunately, the classic presentation is still the dominant character in scientific publications.

We all recognize the strong appeal which beautifully illustrated works on entomology have, both for the amateur and expert. How reverently we poured over the text of EDWARDS' *Butterflies of North America* and lingered over the exquisite colored drawings of MARY PEART, and how thrilling it was to read the scholarly excurses in SCUDDER'S *Butterflies of the Eastern United States and Canada,* and note the many fine drawings. Others must have wondered as we did at the skill that was evidenced in

the wood engravings of ANNA BOTSFORD COMSTOCK which illustrated many of the works of her husband, JOHN HENRY COMSTOCK. Most of us are familiar with the classic papers of C. V. RILEY, in the *Missouri Reports* and other writings, in which much of the appeal lies in RILEY's drawings. It has long been recognized that the scholarly works of ALPHEUS S. PACKARD, when illustrated by JOSEPH BRIGHAM, as in the Monographs of the Notodontidæ and the Ceratocampidæ, are particularly outstanding.

Some of these entomological "old masters" had the advantage of reasonably priced color reproduction. Today we are denied this. We can only hope that at some future time a cheaper process of color printing will be invented, and kept free from the dictation of union labor bosses.

The editors and/or business managers of some of our journals have not always recognized the value of illustrations. In most cases this is probably due to budgetary limitations. It is disheartening to find that, with many technical journals the contributing authors are required to pay for illustrations. It would seem to me more advantageous to cut down on the number of pages and put the saving into good illustrations.

This is the policy that was followed during the past forty years by the Southern California Academy of Sciences, thanks to the backing and support of a cooperative Board of Trustees. The steady growth of that organization and its high scientific standing seems to suggest that the policy was efficacious.

We should all offer congratulations to the governing body of our Lepidopterists Society for the stand they have taken in this respect. They have established a special "illustrations fund". We should do all in our power to help in this endeaavor, and hope that eventually someone will set up an endowment for that specific purpose.

One other aspect of this subject should be considered. I have occasionally seen publications in which the authors used good drawings that were obviously made by competents, without giving credit to the illustrators, reprehensible whether it is done intentionally or by oversight. Most scientific illustrators not only have had long training in their craft, but have a good grasp of the fundamentals of the subject that they are illustrating. Illustration adds greatly to any work and should be accorded full recognition. The author will himself benefit by giving adequate credit to the associate artist.

There is a challenge in these meticulous demands for all of us who have a part in the training of our novitiates.

JOHN ADAMS COMSTOCK

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ESPECIALLY FOR FIELD COLLECTORS

(Under the supervision of Fred T. Thorne, 1360 Merritt Dr., El Cajon, Calif., U.S.A.)

BUTTERFLY MIGRATIONS IN MARCH IN NORTHERN MEXICO

by Richard Heitzman

The freezing weather of 1961-62 spreading through southern Texas, killing the majority of the tropical growth in the area, resulted in very poor collecting for butterflies in the Rio Grande Valley. As a result of this my collecting partner William Howe and I decided to try for á few days collecting further south in Mexico. We entered Mexico through Matamoros on 21 March 1962 and headed south on the highway to CD. Victoria. About one hundred miles south of Matamoros a clogged fuel line caused a three hour delay which was used for collecting butterflies along the sides of the road. Butterflies were numerous, with many *Phœbis* and *Kricogonia* beating their way along the roadsides. We soon noticed that a small migration of *Libytheana bachmanii larvata* Strecker was in progress. All specimens observed were flying rapidly to the south from five to ten feet above the ground. Many specimens were caught and examined and all were found to be dull worn individuals. When released they would dash off to the south again. After we became aware that a migration was in progress, an attempt at counting was started, and in the next three hours, from 11 am until 2 pm, we counted 139 specimens. None were observed stopping at flowers or moist places along the road.

With the car operating again we continued south and about fifty miles north of CD. Victoria the first *Danaus plexippus* Linnæus of the season was sighted. From this point on, scattered specimens were noted flying lazily to the northeast. UV light collecting during the evening surprised us by drawing in a big male *D. plexippus*. The next morning, 22 March, we left CD. Victoria heading south again for CD. Mante. We soon noticed a marked increase in the numbers of *D. plexippus*, and it was apparent that we were in the midst of a large migration. We started counting the ones that flew across in front of the car and found that 60 to 80 were passing for every mile traveled. These were only the ones flying directly in front of the car. The yellow flowers of the Palo Verde trees along the sides of the road were swarming with Monarchs. When we stopped the car and got out to look about, the species was everywhere, flying from a few feet above the ground far up into the sky until hardly

visible. All those flying were traveling at a leisurely rate to the northeast. These large numbers continued for the next 70 miles until we reached CD. Mante about 2:30 in the afternoon. The trees in the motel yard where we stayed were covered with resting Monachs. The owner told us they had appeared the day before, the same day that a heat wave jumped the temperatures about 30 degrees. For the next three days numbers of migrators were observed in the area but never approached the numbers of 22 March. When we returned to Brownsville, Texas, on 26 March, *D. plexippus* was common where not a one had been observed before. On 27 March we spent the day on Padre Island, about 30 miles east of Brownsville. Along the eastern shore many dead Monarchs were found washed up along the beach, apparently individuals that tried unsuccessfully to extend their flight across the Gulf.

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WILLIAM MARK DAVIDSON (1887-1961)

WILLIAM M. DAVIDSON, a member of the Lepidopterists' Society since 1948, died on 6 November 1961, at Orlando, Florida, where he had lived following his retirement in 1947.

He was born in Edinburgh, Scotland, 27 May 1887, and received his early education at Glen Almond School, Glasgow. In 1960 he emigrated to the United States, and he became a naturalized citizen in 1913. He was married in 1912 and had two children. He attended Stanford University and in 1910 received the A. B. degree. He was a Scientific Assistant in the U. S. Bureau of Entomology from 1911-20 and served as Assistant Entomologist and later Senior Entomologist in the U. S. Food Distributing Administration, 1920-46. His stations included Santa Clara and Sacramento, California, and Greenbelt, Maryland. He became a specialist in insecticides and in insects affecting citrus culture, especially the Orange Thrips and San Jose Scale.

Mr. DAVIDSON published several short notes in the *Lepidopterists' News*. His chief interest aside from Nearctic Lepidoptera was in bird banding. He was Secretary of the Florida Audubon Society from 1949 to 1961.

GEORGE W. RAWSON, 603 Faulkner St., New Smyrna Beach, Fla., U. S. A.

RECENT LITERATURE ON LEPIDOPTERA

(Under the supervision of PETER F. BELLINGER)

B. SYSTEMATICS AND NOMENCLATURE

Stallings, Don B., & J. R. Turner, "A new species of *Agathymus* and a new subspecies of *Megathymus* (Lepidoptera, Rhopalocera, Megathymidæ)." *Ent. News,* vol.71: pp.109-115, 2 pls. 1960. Describes as new *A. freemani* (near Bagdad, Ariz.; foodplant *Agave "deserti"*); *M. yuccæ browni* (Salina, Utah; foodplant *Yucca harrimaniæ*). [P. B.]

Stempffer. H., "Description d'un lycène nouveau de la faune malgache" [in French]. *Naturaliste malgache,* vol.2: pp.131-133, 2 figs. 1950. *Eicochrysops pauliani,* a new lycænid from Madagascar (Tsaratanana Mt.). [P. V.]

Stempffer, H., & N. Bennett, "Révision des genres appartenant au groupe des *Iolaus* (Lep. Lycænidæ)" [in French]. *Bull. Inst. franç. Afrique noire,* (*A*), vol.20: pp.1243-1347; vol.21: pp.227-235; 199 figs. 1958-59. Very important paper on the revision of the genera belonging to the *Iolaus* group. After a history of the genera and an indication of the method of study, the authors give a key to the subgenera of *Iolaus;* after this key every subgenus with the species and subspecies are successively studied. The presentation is not correct; the names of subgenera are not in parentheses and appear like names of genera. For example, p.1255, in *Hemiolaus cœculus, Hemiolaus* is used in this paper for a subgenus, not a genus. The correct form is *Iolaus* (*Hemiolaus*) *cœculus* according to the *Règles.* The following taxa are described (correct form indicated): *I.* (*Stugeta*) *bowkeri ethiopica* (Ethiopia, Harrar), *I.* (*S.*) *b. occidentalis* (Sierra Leone, Batkanu); *I.* (*Argiolaus*) *lalos kigezi* (Uganda, *Kigezi*), *I.* (*A.*) *crawshayi nyanzæ* (Kenya, Mumias), *I.* (*A.*) *c. elgonæ* (Kenya, Mt. Elgon), *I.* (*A.*) *c. niloticus* (Uganda, Metu Hills), *I.* (*A.*) *c. littoralis* (Kenya, Mombasa); *IOLAPHILUS* n. subgen. (type *menas* H. H. Druce), *I.* (*Iolaphilus*) *maritimus* (Kenya, Kilifi), *I.* (*Iolaphilus*) *ndolæ* (N. Rhodesia, Ndola), *I.* (*Iolaphilus*) *vansomereni* (Uganda, Metu Hills), *I.* (*Iolaphilus*) *æquatorialis* (Uganda, Katera), *I.* (*Iolaphilus*) *cottrelli* (Uganda, Kamengo), *I.* (*Iolaphilus*) *kayonza* (Uganda, Kigezi); *PHILIOLAUS* n. subgen. (type *parasilanus* Rebel), *I.* (*P.*) *parasilanus maesseni* (Br. Togo, Ho); *I.* (*Epamera*) *mimosæ rhodosense* (S. Rhodesia, Umtali), *I.* (*E.*) *aphnæoides mafugæ* (Uganda, Kigezi); *I.* (*E.*) *moyambina* (Sierra Leone, Moyamba), *I.* (*E.*) *longicauda* (Nigeria, Ikom), *I.* (*E.*) *dubiosa* (Tanganyika, Amani), *I.* (*E.*) *penningtoni* (S. Rhodesia, Hot Springs); *ETESIOLAUS* n. subgen. (type *catori* Bethune-Barker). [P. V.]

Štys, Pavel, "On the lepidopterous nature of the previously dipterous genus *Dahlica* Enderlein 1912 (Lepidoptera, Psychidæ–Diptera, Fungivoridæ)" [in English; Czech summary]. *Acta Soc. ent. čechosloveniæ,* vol.57: pp.76-83. 1960. Very important taxonomic study about Psychidæ. The genus *Dahlica,* classified previously in Fungivoridæ, is transferred to Psychidæ. The subfamily Dahlicinæ must be considered as synonymous to "Psycheoidinæ", *sensu* Kozhanchikov 1936. *Dahlica* in all probability is synonymous to *Solenobia.* [J. M.]

Thompson. W. R., "The interpretation of taxonomy." *Proc. 10th internat. Congr. Ent.,* vol.1: pp.61-73, 3 figs. 1958. Suggests that the complex interrelationships of species can better be explained by a fixed type system than by phylogeny. The author's argument is interesting, but he confuses gaps in zoological knowledge with gaps between types, and his mathematical explanation of a series of discrete types analogous to the periodic table of elements is no substitute for a causal explanation of organic diversity. [P. B.]

Tiedemann, Oswald, "*Vitula serratilineella* Ragonot (Lep. Pyralidæ). Ein in Europa heimisch gewordener nordameriganischer Kleinschmetterling" [in

German]. *Zeitschr. wiener ent. Ges.*, vol.43: pp.282-286, 2 pls. 1958. Sinks *Moodna bombylicolella* to this North American species which is established around Hamburg, where it was apparently introduced with dried fruit during the last 20 years. Regards the sp. as distinct from *V. edmandsæ* on grounds of differences in external appearance & biology. [P. B.]

Tilden, J. W., "Studies in the genus *Ochlodes* Scudder II. The type material of the North American species (Lepidoptera: Hesperiidæ)." *Ent. News.* vol.72: pp.37-45. 1961. Types of Boisduval's spp. are in the British Museum; lectotypes of Edwards' spp. are selected from material in the Carnegie Museum & University of Kansas Museum; a neotype of *O. yuma* (Edw.) is designated & will be deposited in the Carnegie Museum. The types of *francisca* & *amanda* Ploetz cannot be located, & the application of the names is uncertain. [P. B.]

Tindale, N. B., "Revision of the ghost moths (Lepidoptera Homoneura, family Hepialidæ) part VII." *Rec. South Australian Mus.*, vol.13: pp.157-197, 8 pls., 35 figs. 1958. Describes as new *Endoclita paraja* (?Borneo), *E. aikasama* (Java), *E. aurifer* (Java), *E. broma* (Java), *E. salvazi* (Laos), *E. aroura* (Sumatra), *E. raapi* (Nias), *E. topeza* (Laos), *E. warawita* (N. Borneo), *E. williamsi* (Los Banos, Philippine Is.), *E. taranu* (Sumatra), *E. hosei* (Sarawak), *E. kara* (Java), *E. ijereja* (Borneo). Figures types & ♂ genitalia. [I. C.]

Tite, G. E., "On three new species of the genus *Syntarucus* from the African region (Lepidoptera, Lycænidæ)." *Entomologist*, vol.91: pp.189-191, 1 pl. 1958. Describes as new *S. brevidentatus* (W. shore of L. Manyara, Tanganyika), *S. casca* (Anjouan Is., Comoro Islands), *S. mayottensis* (Mayotte, Comoro Islands). [P. B.]

Tite, G. E., "New species of, and notes on, the genus *Lepidochrysops* (Lepidoptera, Lycænidæ)." *Entomologist*, vol.92: pp.158-163, 6 figs. 1959. Describes as new *L. albilinea* (Bahr el Ghazal), *L. ansorgei* (Bange Ngola, Angola), *L. flavisquamosa* (Zambezi-Congo Divide, Moxico Distr., SE Angola), *L. nigritia* (Raga, S. Bahr el Ghazal), *L. ringa* (Ringa, N. Nigeria). Notes on *L. æthiopia* & *L. naidina*. [P. B.]

Tite, G. E., "The genus *Catachrysops*, Lepidoptera, Lycænidæ." *Entomologist*, vol.92: pp.201-212, 2 pls., 8 figs. 1959. Describes as new *C. strabo luzonensis* (Montalban, Rizal, Luzon), *C. s. celebensis* (Macassar), *C. panormus andamanica* (Port Blair), *C. p. batchiana* (Batjan), *C. p. papuana* (Kumisi R., NE Br. New Guinea), *C. p. pura* (Isabel Is., Solomons), *C. p. argentata* (Guam), *C. p. timorensis* (Dili, Timor), *C. p. cærulea* (New Hebrides), *C. nubila* (Ysabel Is.). Revision of genus; all forms grouped in the spp. above except for the monotypic *C. binna*, *C. amasea*, & *C. taitensis*. [P. B.]

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Todd, E. L., "A note on *Acronicta rapidan* (Dyar) (Lepidoptera, Noctuidæ)." *Proc. ent. Soc. Wash.*, vol.61: p.278. 1959. First U.S. records; sp. distinguished from *A. connecta*, of which it may be a southern race. [P. B.]

Toll, S., & R. J. Wojtusiak, "Revision of the Palæarctic forms of the genus *Paratalanta* Meyr. (Pyralidæ)" [in English; Russian & Polish summaries]. *Acta zool. cracov.*, vol.2: pp.279-312, 4 pls. 1957. As new is described *P. stachialis* from Manchuria. [J. M.]

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Polska Akad. Nauk, vol.17: pp.65-89. 21 figs. 1958. Describes as new *Bactra gozmanyana* (Stemplew, Kreis Turek, Poland); *Epiblema baligrodana* (Bieszczady (Wald-Karpaten), Baligród-Czarne), *E. petasitis* (same locality). Compares *B. gozmanyana* in detail with *B. lanceolana, B. robustana,* & *B. furfurana.* [P. B.]

Toll, S.. "Neue Acrolepiidæ. Beschreibung von vier neuen Arten aus der Sowjetunion" [in German]. *Zeitschr. wiener ent. Ges.,* vol.43: pp.84-89, 8 figs. 1958. Describes as new *Acrolepia volgensis* (Krasnoarmiejsk, Sarepta), *A. christophi* (Transcaucasia, Ordubad), *A. sibirica* (E. Siberia, Vladivostok); *Rœsslerstammia transcaucasica* (Transcaucasia, Berzhomi). [P. B.]

Toll, S., "Studies on species of the Lepidoptera of the *Cacœcia podana* Scop. (Tortricidæ) and *Pyrausta sanguinalis* L. (Pyralidæ) groups" [in Polish; English summary]. *Bull. ent. Pologne,* vol.28: pp.109-124, 3 pls. 1958. Describes as new *P. latefascialis* (Djalantun, Manchuria). The ♀ of *C. criticana* is described. *C. ingentana* & *C. subrufana* are distinct (good) spp; *P. auroralis* is a southern variety of *P. virginalis,* not a good sp. Imagines & genitalia are figured. [J. M.]

Toll, Sergius, "Eine neue *Coleophora* aus dem Naturschutzgebiet bei Oberwinden im Marchfeld, Niederösterreich" [in German]. *Zeitschr. Arbeitsgem. österr. Entomologen,* vol.12: pp.81-82, 4 figs. 1960. Describes as new *C. pseudorepentis.* [P. B.]

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de la Torre y Callejas, S. L., "Reconsideracion taxonomica de las especies del genero *Kricogonia* Reakirt, con vista al estudio de sus organos genitales" [in Spanish]. *Publ. Univ. Oriente,* no.42: 32 pp., 2 pls. 1958. Reviews taxonomic history of genus and all named forms; concludes that valid spp. are *K. castalia* (with ssp. *K. c. lyside*) & *K. cabrerai,* all other names being synonyms or applying to infrasubspecific forms. Gives key to recognized forms and figures all in color. [P. B.]

de la Torre y Callejas, Salvador Luis. & Pastor Alayo Dalmau, "Revision de las Notodontidæ de Cuba, con la descripcion de dos nuevas especies" [in Spanish]. *Publ. Univ. Oriente,* no.43: 60 pp., 15 pls., 5 figs. 1959. Describes as new *Disphragis zayasi* (Vista Alegre, Santiago de Cuba); *Meragisa toddi* ("La Breña", Moa, Oriente). Lists 25 spp. (including an unidentified sp. of *Disphragis*), with brief descriptions, figures of adults & genitalia, and notes on distribution. [P. B.]

de la Torre y Callejas, Salvador L., "Estudio de los órganos genitales de las Sphingidæ de Cuba contenidas en la collección de la Universidad de Oriente" [in Spanish]. *Rev. Univ. Oriente,* vol.1: pp.39-75, 15 pls. 1960. Lists the 59 Cuban spp.; figures ♂ genitalia of 44 spp. & ♀ genitalia of 40. [P. B.]

Toulechkoff, K., "Études faunistiques d'Olympe de la Grèce (Lepidoptera)" [in Bulgarian; Russian & French summaries]. *Bull. Inst. zool. Acad. bulg. Sci.,* vol.1: pp.305-328, 3 figs. 1951. A number of spp. & sspp. from the Olympus region in Greece are described as new: *Agrotis multangula stojanovi, A. cuprea jordanovi, A. stavroitiacus, A. decora olympica; Hadena platinea grisescens; Eupithecia olympica.* Only the new spp. are figured. [J. M.]

Torstenius, Stig, "Några anteckningar rörande Europas *Nycteola* Hb. (*Sarrothripus* Curt.) (Lep. Noctuidæ)" [in Swedish; English summary]. *Ent. Tidskr.,* vol.81: pp.63-73, 2 pls., 15 figs. 1960. Describes & figures genitalia of *N. revayana, N. degenerana, N. siculana, N. columbana, N. kuldzhana,* & *N. asiatica;* summarizes distribution of first three spp., which occur in Sweden. [P. B.]

Townsend, A. L. H., "Four new species of African Heterocera." *Entomologist,* vol.91: pp.204-206, 1 pl. 1958. Describes as new: (Noctuidæ) *Antarchæa magalium* (Nakuru, Kenya); *Osericana pernix* (Nakuru); (Geometridæ) *Lophorrhacia burdoni* (Mufindi, Tanganyika); (Pterophoridæ) *Platyptilia illustris* (Nakuru). [P. B.]

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JOURNAL OF
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THE TYMPANIC STRUCTURES OF THE LEPIDOPTERA AND THE TAXONOMY OF THE ORDER

by SERGIUS G. KIRIAKOFF

Part XV (on the Hypeninæ and Herminiinæ) of my "Recherches sur les organes tympaniques des Lépidoptères en rapport avec la classification" (Studies of the tympanic organs of the Lepidoptera as a criterion of their classification), which appeared in 1960, completed the series begun in 1948. A short paper appeared in the *Lepidopterists' News* in 1952, in order to acquaint the readers with the progress of the investigation and with the important bearings thereof on the classification of the Lepidoptera (Kiriakoff 1952b).

Now that the study has been terminated, it may perhaps be of some interest to give a short summary of the research and of its final results regarding the classification of the groups involved. Stress should be also laid on the very important earlier work by A. GLENN RICHARDS, CHIN JEN LUH, I. GOHRBANDT, and H. SICK, not to speak of the pioneer in the field, Professor F. EGGERS. The latter had for the first time described the various types of tympanum and outlined the principal divisions of the tympanum-bearing groups. As it is now known, there are two main position-groupings of the lepidopterous typanum, viz. the abdominal and the thoracic type. While the question of a possible polyphylety of the abdominal type is still open, there seems to be little doubt about the monophyletic origin of the structure for those groups which possess a thoracic tympanum. Since I have dealt in my research with the latter only, I must refer the reader to the papers by KENNEL and EGGERS, and by GOHRBANDT on the abdominal structures. There are three main groups belonging to the abdominal category, viz. the Pyralidæ, the Geometridæ, and the Thyatiridæ + Drepanidæ, and they are now usually considered as superfamilies.

With reference to the thoracic structures, some excellent work has been done by Richards (1933), who studied in some detail the North American Noctuidæ and more fragmentarily the other groups involved (Arctiidæ, Lymantriidæ, etc.). His conclusions regarding the general classification differ in many points from those dealt with here, mostly, I should think, because of the more complete later research on several groups only superficially studied in his excellent paper. On the other hand, Richards' subdivisions of the family Noctuidæ seem on the whole to be quite acceptable, although he only studied the New World forms. So are the conclusions of Chin Jen Luh (1936) concerning part of the American Arctiidæ; as far as I am aware, only an excerpt of his paper has been published.

I now return to my own work. In order to give a clear picture of what has been done, I am giving below, in chronological sequence, the essentials of the 15 parts of the "Recherches". The parenthetical dates refer to the papers cited in full in the references at the end of this review.

I. CTENUCHIDÆ (1948). Three main structures have been found: the "normal" or phalænoid type, very similar to that found in the Noctuidæ; a peculiar type with a horizontal tympanum, called the "thyretoid type"; and a much reduced structure, with most, but not all, features vestigial. Gohrbandt (1939a) had already distinguished between these various structures; however, she refrained from making definite taxonomic conclusions. The "thyretoid" forms were later (1949a) placed in the new family Thyretidæ.

II. THAUMETOPŒIDÆ (1949b). These are shown to have the same type of tympanic structures as do the Thyretidæ and Notodontidæ. See also part XIII.

III. DIOPTIDÆ (1950a). This is another group belonging in the vicinity of the Notodontidæ. Some representatives have strongly reduced tympanic structures (subfamily Dioptinæ). The majority, with well developed, sometimes highly specialized structures, form the subfamily Josiinæ.

IV. NOTODONTIDÆ (1950b). A few Indo-Australian forms are aberrant in the shape of the scutal phragm and form the subfamily Tarsolepidinæ (scutal phragm narrow like that in the phalænoid type). The bulk possess a normal notodontoid (*i.e.*, broad and roof-shaped) scutal phragm: subfamily Notodontinæ. The notodontoid group was revised in a paper entitled "Sur la classification et la phylogénie de la superfamille Notodontoidea" (1950c). The superfamily Notodontoidea of d'Almeida was broadened to include the families Thyretidæ, Dioptidæ, and Notodontidæ + Thaumetopœidæ. All the forms possessing a tympanum of the phalænoid (or noctuid) type were, then, placed in the

opposite superfamily Phalænoidea (later renamed Noctuoidea, on priority grounds). Sick (1940) had studied, in a paper that was at the time unknown to me, the family Dioptidæ, as well as a couple representatives of Thaumetopœidæ and Notodontidæ. His study was very complete (90% ~~of the dioptid species), and he~~ recognized 5 main structural types of the tympanum, including the vestigial one referred to above under III. He also was the first to point out the affinities between these several groups. Since he was not a taxonomist, he did not attempt to adjust the classification of the groups involved. Sick died shortly after the end of the Second World War.

V. A short paper (1950d) dealt with the aberrant structures of a few arctiid genera, both Old World and American.

VI. NYCTEMERIDÆ (1951a). The structures of this group do not differ notably from those of the true Arctiidæ.

VII. LITHOSIIDÆ (1951b). Most genera do not differ from the Arctiidæ. A few possess, however, an aberrant type of tympanum, with a complete, closed frame. A new family Endrosidæ (after the palearctic genus *Endrosa*) has been described to include such forms. Further research may disclose more genera belonging to this new taxon.

VIII. COCYTIIDÆ (1951c). This includes the single genus *Cocytia*, not differing, in respect to the tympanic structures, from the Noctuidæ.

IX. ARCTIIDÆ (1952a). Old World forms only were studied. For the American genera, *vide* the paper of Chin Jen Luh (1936).

X. HYBLÆIDÆ (1953). This small tropical group is mostly placed near the Noctuidæ. The moths lack, however, any trace of tympanic structures. Considering some other structural characters of the Hyblæidæ, they should be placed with the Tortricoidea, *i.e.* in an evolutive series that developed quite independently of the Noctuiformes.

XI. AGARISTIDÆ (1955). These are close to the Noctuidæ but possess an unmistakable degree of differentiation, *e.g.* the so-called pleural bulla, a large vesicle at the basis of the abdomen, visible from outside.

XII. LYMANTRIIDÆ (1956a). Some structures, especially the prespiracular cucullus, point towards a closer affinity with the Arctiidæ than with the Noctuidæ. A general survey of the super-family Phalænoidea (*recte* Noctuoidea) led to recognizing but two families, viz. Endrosidæ and Noctuidæ, the latter having two major divisions, one with a prespiracular cucullus (*i.e.*, the cucullus being placed before the first abdominal stigma), including the infrafamilies Arctiidi and Lymantriidi; the other with a postspiracular cucullus (*i.e.*, the cucullus being placed behind the first abdominal stigma), including the infrafamilies Noctuidi (including "Cocytiidæ") and Agaristidi.

XIII. A few Australian genera have been sometimes placed with the Lymantriidæ, sometimes with the Thaumetopœidæ. The tympanum does not differ from that of the latter group, so that the taxonomical position of the *Epicoma*-group is with the Notodontoidea (1956b).

XIV. NOLIDÆ (1958). These are usually considered as a "subfamily" of Arctiidæ. RICHARDS was the first to point out that their true affinities are with the Noctuidæ. However, he had some doubts about the position of the cucullus. This doubt I was able to remove by showing that the cucullus of the Nolidæ is postspiracular. The group should accordingly be placed near Noctuidi as a third infrafamily.

XV. HERMINIINÆ and HYPENINÆ (1960). RICHARDS had made a study of these groups and pointed out that 3 subfamilies could be distinguished therein, viz. Herminiinæ, Rivulinæ and Hypeninæ. As far as the two latter are concerned, the conclusions of RICHARDS have not been supported by my research. For instance, a double pocket IV was found to occur in all the groups indiscriminately, which made it useless as an important differential character. I accordingly placed both Rivulinæ and Hypeninæ with the "Erebine-Catocaline complex" of RICHARDS, a useful and probably natural division. On the other hand, the Herminiinæ possess (as RICHARDS indeed did find) a prespiracular cucullus, contrarily to all other "Noctuidæ", including the Rivulinæ and the Hypeninæ. The former must accordingly be removed from that vicinity and placed with the "prespiracular" division of the Noctuidæ, along with Arctiidæ and Lymantriidæ. The various conclusions reached in the above papers can be briefly tabulated as follows:

Subcohors Noctuiformes

A. (Includes the plesiomorphic sister-branch, *i.e.*, groups which do not have tympanic structures. The most important are the Zygænidæ).

B. The apomorphic sister-branch has tympanic structures present and contains two superfamilies.

- Superfamily Notodontoidea (tympanum of the notodontoid type)
  - Family Dioptidæ
    - Subfamily Dioptinæ
    - Subfamily Josiinæ
  - Family Notodontidæ
    - Subfamily Tarsolepidinæ
    - Subfamily Notodontinæ (the Thaumetopœidæ might be excluded therefrom and placed in a distinct family or subfamily on other grounds than the tympanic structures)
  - Family Thyretidæ

Superfamily Noctuoidea (tympanum of the phalænoid type):
- Family Endrosidæ
- Family Noctuidæ
  - Subfamily Arctiinæ (*Subfam. nova*: prespiracular hood)
    - Infrafamily Lymantriidi
    - Infrafamily Arctiidi
    - Infrafamily Herminiini
  - Subfamily Noctuinæ (*Subfam. nova*: postspiracular hood)
    - Infrafamily Nolidi
    - Infrafamily Noctuidi
    - Infrafamily Agaristidi

The above classification differs very distinctly from the usual one. However, I believe it to correspond more closely with the phylogeny of the higher Lepidoptera, because the tympanic structures undoubtedly are the most significant single set of characters that can be found in the Lepidoptera. Their complexity is extreme, yet they are surprisingly uniform in the various evolutionary lines that can be distinguished among their bearers. There is no doubt that they should be preferred to all other characters such as the wing-venation with all its inconsistencies.

To end this summary, I should like to point out that, in my opinion, all the groups where a tympanum occurs should be investigated for that structure. The classification of groups such as the geometrids and the pyralids cannot be considered as satisfactory so long as next to nothing is known about their tympanic structures. It is surprising to find that, since the times of Kennel and Eggers nobody has ever cared (with the exception of Gohrbandt who wrote a paper on the uraniid type of tympanum) to follow up the pioneer work of those two great lepidopterists. I can only hope that some student will undertake this immense but glorious task in order to bring our knowledge of the groups just referred to the level of what is now known about the Noctuoidea.

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ECOLOGICAL STUDIES OF RHOPALOCERA IN A HIGH SIERRAN COMMUNITY – DONNER PASS, CALIFORNIA. II. METEOROLOGIC INFLUENCE ON FLIGHT ACTIVITY

by Thomas C. Emmel and John F. Emmel

The present paper reports a study of Rhopalocera flight patterns and meteorological fluctuations at Donner Pass (Placer County) – a typical Canadian Zone area in the Sierra Nevada mountain range of California. The authors have spent a total of over six months in two different years investigating the Donner Pass region. The senior author (T. C. E.) surveyed the area in 1956, delineating vegetation zones and general Rhopalocera distribution and activity in the various habitats. A subsequent intensive investigation was planned in the spring of 1960 and that summer one of us (J. F. E.) obtained the meteorologic and flight activity data described in this report.

Introduction

Probably since the first collector in medieval Europe stopped outside with a net in his hands, it has been observed that times of emergence and flight of butterflies and most other insects tend to be adjusted to the surrounding environmental conditions. In our previous paper (1962), we noted that climatic factors govern the general distribution of butterflies; anyone interested in this phase of zoogeography should read Wiltshire (1957), who discusses the influence of desert, plain, and mountain climates on the distribution of Iraq's Lepidoptera. But within the area of distribution, weather directly affects the seasonal occurrence and fluctuation in numbers of the insects.

Some of the most striking examples of this important effect are found among the butterfly species of the southwestern deserts. Bauer (1955) remarks that *Papilio rudkini* Comstock has a very irregular flight period in the desert mountains, with captures recorded from January through November. Bauer states that rainfall seems to be "the deciding factor as to when it may be found."

Hovanitz (1948) has studied the differences in field activity of the two female color phases of *Colias eurytheme* Boisduval during the day. He found different frequencies of each color phase (within the population of a specific locality) at different times of the morning and afternoon. Total activity was found to be dependent upon various temperature and solar radiation combinations; further discussion on certain aspects of his important studies of flight activity will be considered later.

EHRLICH (1954) states that *Erebia rossii* Curtis flies on "the warmest, stillest, brightest days." An interesting aspect of local climatic influence on butterfly species is this author's comment that, because of the weak flight of this *Erebia*, "prevailing winds cannot be discounted as a possible major guiding agency in the dispersal and subspeciation of *rossii*."

Other investigations have found climatic influence on mosquito populations. PLATT *et al.* (1958) found "a 100% positive correlation . . . between relative humidity and the abundance of *Aedes vexans*," while GOODWIN and LOVE (1957) found that extremely high air temperatures would greatly decrease numbers of mosquitoes. Many other examples of environmental studies with various invertebrates can be found in the literature.

In our previous paper, we considered the influence of vegetation and altitude (as well as various intrinsic factors) on the occurrence of butterfly species in a particular area. In this present paper, we wish to consider what governs the apparent rarity and abundance of a species within an area where it occurs. LACK (1954) found that food abundance is a limiting factor on bird populations, but this is obviously not the case with most butterflies, as the food plant is generally much more abundant than the butterfly (see Emmel & Emmel, 1962). A study of population size for each species in Donner Pass was not intended. Instead, we present herein data on the relative daily abundance of each of six butterfly species (from five families), along with records of daily weather conditions, and an attempt is made to show how these extrinsic (meteorologic) conditions affect the *flight activity* on each day within the flight period.

DESCRIPTION OF STUDY AREA

Donner Pass has had a long history of climatic influence on the lives of men and beasts. The heavy snows of the region attained unfortunate fame in 1846, when the Donner Party was trapped below the Pass. Even today, miles of strong wooden snow sheds stand over the railroad tracks for protection against the fierce storms.

Snowmelt occurs in early June, while snow flurries can be expected in early September. Sandwiched between nine months of winter – spring, summer, and fall in the Donner Pass area must rapidly pass in seccession. Thus it is that butterflies and plants come out together as soon as bare ground appears, and the flight or growth seasons are measured in weeks instead of months.

The Lodge meadow area was the particular region studied for collecting data on daily flight numbers of the six most abundant Rhopalocera.

The Lodge meadow area studied in Donner Pass, Placer County, California. Moist in June, the meadow becomes progressively drier during the summer and plants such as Yarrow (in the foreground) become dominant on the gentle slope between the South Yuba River and the base of Mt. Disney.

This study area, approximately 500 by 800 feet, is bounded on the north by the South Yuba River, on the west by willow thickets and forest, on the south by the slope of Mt. Disney, and on the east by a dirt road and forest. It lies at an elevation of approximately 6960 feet above sea level. In June, the meadow here was wet and grasses, with many wildflowers, grew in verdant abundance. As the summer progressed, the meadow dried slowly and such plants as Yarrow (*Achillea millefolium*) and Fireweed (*Epilobium angustifolium*) replaced the earlier wet meadow inhabitants. The reader is referred to our earlier paper for further habitat description.

Methods

Within the Lodge meadow area, daily counts on numbers of butterflies in flight were made. The method employed was counting by direct observation in a two hour period: 10-12 A.M., Pacific Standard Time.

Table 1. MAXIMUM NUMBERS OF INDIVIDUALS OBSERVED IN ANY TWO-HOUR PERIOD FOR SIX SPECIES.

Species	Number observed	Date
Parnassius clodius baldur	40	June 27
Colias eurytheme	55	June 23
Chlosyne hoffmanni	120	July 7
Nymphalis californica	650	July 21
Plebejus icarioides	39	June 28
Pyrgus communis	52	July 20

These counts were made through continuous crossings of the study area by the observer. In using numbers seen per two-hour period as an index of abundance, we are following EHRLICH's suggestion (1959).

Determination of the size of natural populations is very difficult, as pointed out by BROWN (1951). One can only obtain crude estimates and the results should be interpreted "as estimates of the *lower* possibility of size." In our case, a complete count of the population (possible in "marking" experiments; see Ehrlich, 1961) was not necessary; we desired to compare the *relative* numbers of flying adults from day to day.

In order to avoid false comparisons of one species' abundance with that of another species (which may not prefer the meadow habitat as much as others), all comparisons were calculated as follows. The number of individuals on each day was divided by the maximum number counted on any one day (see Table I) during the summer to obtain the percent of flying butterflies for each date. That is if Y = number of individuals observed, then Y/Y max $\times$ 100 = percentage or index of activity. Obviously, the above method of counting and of calculation has statistical limitations but the authors believe the results are accurate enough for the purpose: to compare relative abundance of flying butterflies with meteorological conditions on a day-to-day basis.

Meteorological data were obtained from standard instruments maintained by the staff of the Audubon Camp in the Lodge meadow. Relative humidity and barometric pressure were taken at 5:30 P.M., P. S. T. Degree of cloudiness figures represent approximations of the areas of visible sky and of clouds during the daylight hours.

RESULTS AND DISCUSSION

The six butterfly species selected for the flight activity graph (Fig. 3) represent five major Rhopalocera groups found in the Donner Pass area. These were: *Parnassius clodius baldur* Edw. (Papilionidæ), *Colias*

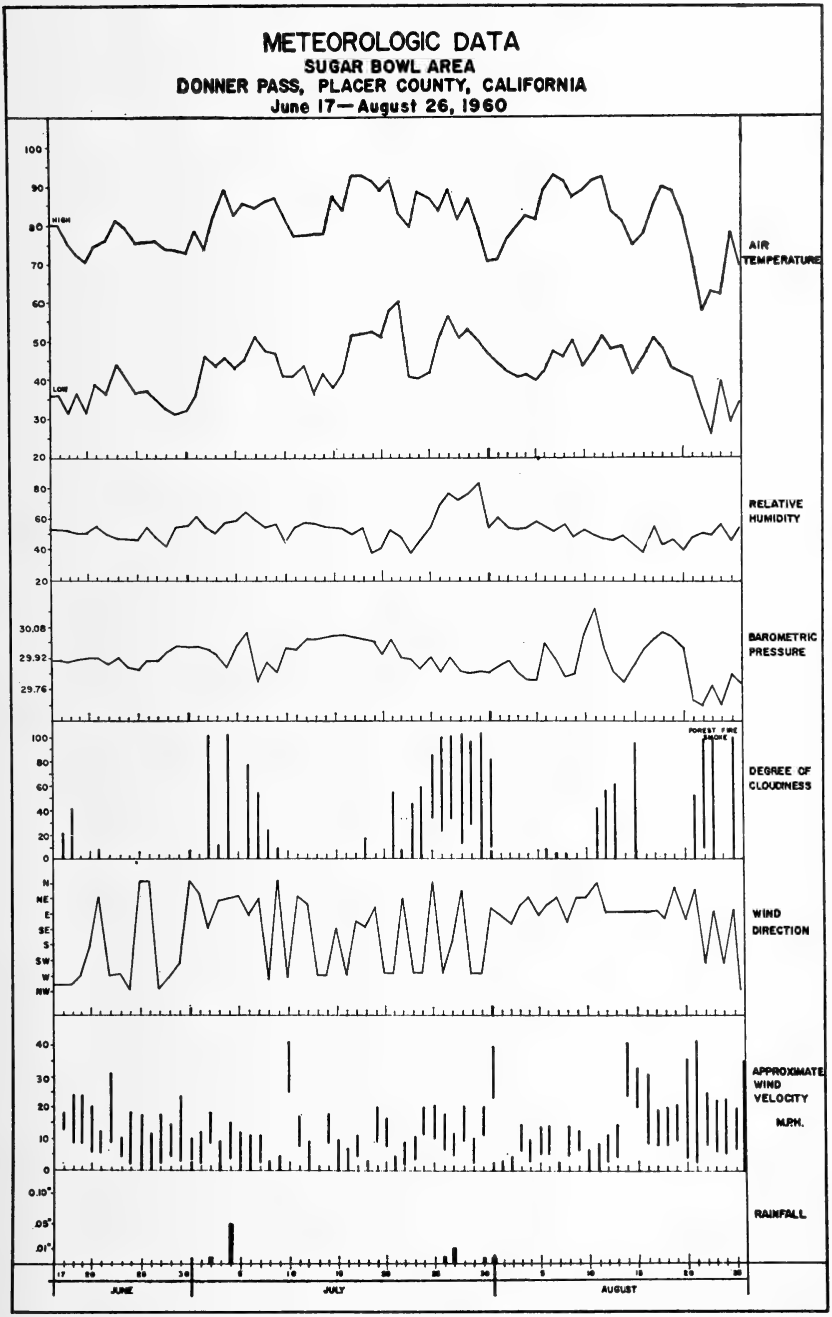
METEOROLOGIC DATA
SUGAR BOWL AREA
DONNER PASS, PLACER COUNTY, CALIFORNIA
June 17—August 26, 1960
HIGH
LOW
AIR TEMPERATURE
RELATIVE HUMIDITY
BAROMETRIC PRESSURE
30.08
29.92
29.76
FOREST FIRE SMOKE
DEGREE OF CLOUDINESS
N
NE
E
SE
S
SW
W
NW
WIND DIRECTION
APPROXIMATE WIND VELOCITY
M.P.H.
0.10"
.05"
.01"
RAINFALL
JUNE
JULY
AUGUST

Figure 2

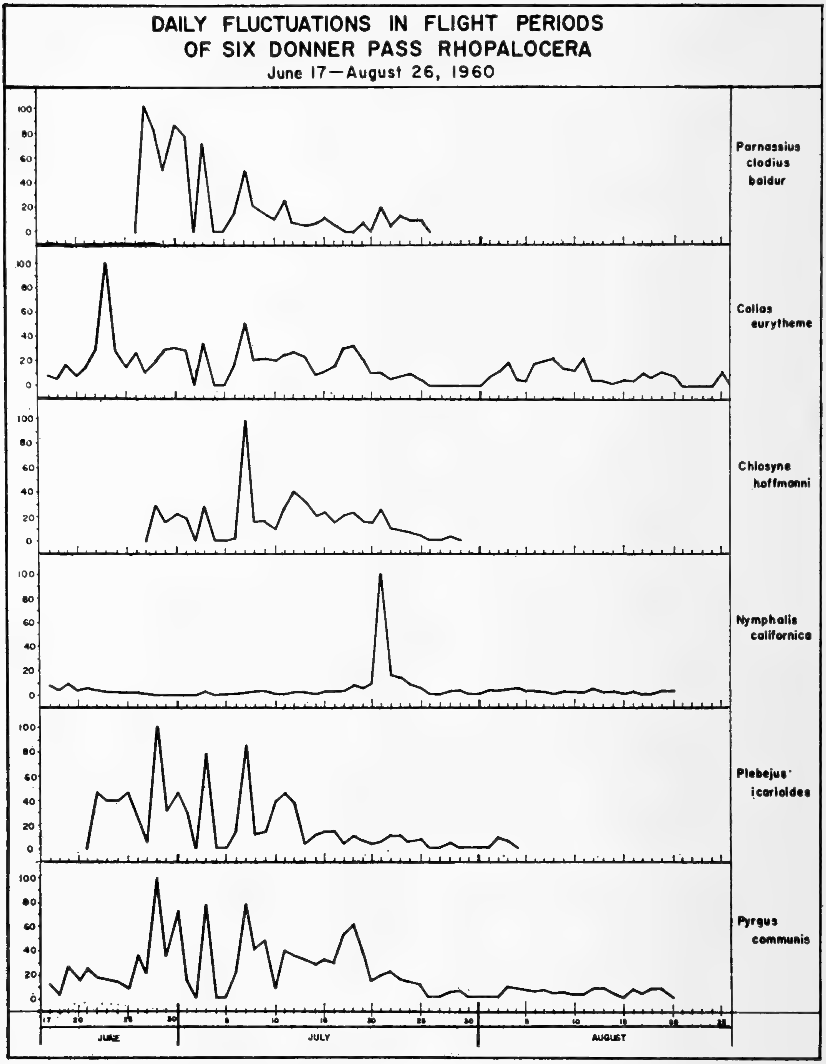

Figure 3

eurytheme Bdv. (Pieridæ), *Chlosyne hoffmanni hoffmanni* Behr and *Nymphalis californica* Bdv. (Nymphalidæ), *Plebejus icarioides* Bdv. (Lycænidæ), and *Pyrgus communis* Grt. (Hesperiidæ).

The flight periods of three species (*C. eurytheme, N. californica, P. communis*) began before June 17, the date of first observations, and extended into late August (two generations of adults occurring within this time). The flight periods of the other three butterflies began in late

June after observations were underway, and terminated in late July. Thus it is interesting to compare the effects of meteorological conditions on each of the long-term and short-term fliers, which we shall do (individually) during the following discussion of our data.

A. General Trends of Activity

For four species (and perhaps *C. eurytheme,* too), there seemed to occur a large emergence and much flight activity at one time, near or at the beginning of each species' flight season. The "hump" of high activity slopes down to rather low levels after about 10 to 15 days. The peak flight dates for these particular species were:

P. clodius: June 27-July 7
C. hoffmanni: July 7-12
P. icarioides: June 23-July 11
P. communis: June 26-July 9

Following these peak periods in each species was a long "trailing-off" period, in which few individuals were found, and those collected were usually worn and old.

Colias eurytheme, from our data, appears to have two "humps" of higher flight activity, one extending from late June to early July and a second beginning in the first week of August. This second occurrence, with a week or so of low abundance of typical *eurytheme,* represents for the most part the emergence of the form "amphidusa", which replaced typical *eurytheme* to a very considerable extent during August.

Nymphalis californica occurred at low population levels throughout the summer, but on July 21, a mass emergence took place with the new adults migrating out of the area that afternoon in a westerly direction. Notes on this butterfly's ecology are mentioned in our previous paper. The possible cause of this mass emergence will be treated shortly.

To our knowledge, none of the six species exhibited sexual dichronism in respect to the time of emergence; that is, both sexes of these species emerged concurrently (synchronous) or with not more than several days' difference. It would be interesting to graph flight-period data on a *Speyeria* species or *Lycæna arota* Bdv., for instance; one would likely find two peaks or perhaps a long plateau if the males remained at a state of high activity until the females emerged *en masse.*

B. Stimulus for Emergence of Short-term Fliers

By considering the meteorological and flight activity data in Figures 2 and 3, it is possible to see certain weather situations that could account for butterfly emergence.

Parnassius clodius and *Chlosyne hoffmanni* apparently began to emerge around the 26th of June. For the previous seven days weather conditions had been generally mild, with the daily high temperatures between 70 and 80 degrees, no cloudiness or rain, steady humidity and barometric pressure levels, and fairly low-velocity afternoon winds. Up to June 22, however, the night temperature was often near freezing; on June 23, the low was 43° F. This rather high "low" temperature (for June) could have provided the necessary stimulus for almost immediate emergence, especially in the case of *Plebejus icarioides,* which emerged in numbers from June 22 on.

The stimulus for the mass emergence of *Nymphalis californica* was evidently a five-day period of very high temperatures. The mature larvæ were very abundant in the first week of July, and the pupal stage lasted approximately two weeks. It is interesting to note that immediately after this date, the barometric pressure fell, with high degrees of cloudiness, high relative humidity and some rain. It is perhaps not impossible that the butterflies could "sense" this drop in pressure, or, more likely, the several days of unusually high temperatures. FRANK SALA (1961) and others have remarked on the apparent ability of the members of the *Saturnia albofasciata* group to "choose" to emerge on precisely a certain day after the beginning of the warm "Santanna" winds in southern California (see Stevenson, 1960) during late fall.

C. CORRELATIONS OF METEOROLOGICAL DATA WITH DAILY FLIGHT ACTIVITY

I. TEMPERATURE

Our hypothesis before collecting the data reported herein was that a positive correlation would be found between increase in temperature and increase in butterfly activity. For several reasons, this hypothesis was not substantiated. First, the daily high temperature never fell below 70° F. until August 21. This meant the high temperature ranged from 70 to about 95 degrees, and all Sierran species known to the authors would be active in such a range. Thus it was found in a scatter-dot correlation diagram (plotting per cent of butterfly activity versus the number of degrees Fahrenheit) that the butterflies were both highly active and inactive under the same temperature conditions, with no noted increase in butterfly numbers with increase in temperature. On July 5, for instance, at a high temperature of 90°, no butterflies flew in the morning. This was due to a heavy rain on the preceding day (which thoroughly wetted the vegetation); this is the sort of interrelationship of the data that must be taken into account. However, in areas of very high

temperatures (well above 90° around noon), HOVANITZ (1948) found that with *Colias* "a period of minimum diurnal activity occurred about the middle of the day," so there may even be a negative response in activity with such temperatures.

Secondly, as the high-low temperatures were recorded as such for the entire 24-hour day, the "high" temperature does not necessarily reflect the situation between 10 and 12 o'clock in the morning. Thus a cool temperature in the morning may have limited flight during that time. But in the three *Colias* populations studied by HOVANITZ (1948), "the activity of the females was greatest at some point during the morning," and this point was found by him to be "earlier in the day in the more southern populations."

II. RELATIVE HUMIDITY AND BAROMETRIC PRESSURE

Relative humidity generally ranged between 40 and 60 per cent; by definition, this factor is dependent upon temperature. The only sharp change (remembering that this condition was only measured at 5:30 P.M.), outside of times of rain, was an increase to the 80 per cent level from July 27 to 29. Unfortunately, there was no considerable butterfly activity at the end of July (both preceding and following these dates), so no conclusions on the effect of relative humidity on butterfly activity can be drawn from our study.

Cloudiness and rain were accompanied by a drop in barometric pressure, but it is believed that the former factors' physical effects of decreasing solar radiation and of wetting the vegetation were probably the significant causes of drops in flight activity, rather than the drop in pressure (but refer to our previous remarks on *Nymphalis californica* emergence).

For both these meteorological factors, studies in tropical habitats with hourly changes in humidity and barometric pressure would likely provide more interesting and conclusive evidence for effects on flight activity.

III. DEGREE OF CLOUDINESS

The effect of degree of daily cloudiness on flight activity is believed here to be shown of considerable significance. By considering the period of highest activity (June 27 to July 9) in four species, and graphing degree of cloudiness versus percentage of activity during this time, we find an apparent direct negative correlation; that is, with increasing cloudiness butterfly activity decreases. On clear days during this period, flight activity varied from 0 to 100%, with other factors being responsible

for this spread of activity. The seven days of varying cloudiness during this time of high butterfly emergence made correlation work possible; the other three general periods of cloudiness (late July and in August) occurred towards the end of times cf emergence and abundance of the species considered.

Amount of solar radiation or light intensity is dependent upon degree of cloudiness in a significant way. Direct sunlight is lessened or completely obscured by clouds, and these six butterflies do not fly when the extreme situation occurs. Thus here exists a direct correlation between flight activity and solar radiation. There is also a close correlation between solar radiation and daily temperature. HOVANITZ (1948) found in *Colias* that "activity is greatest along a peak line ranging from high temperature and low solar radiation to low temperature and high solar radiation."

A unique opportunity to study the effects of smoke on flight activity was provided by a large forest fire near the Pass, beginning August 20. Virtually all flight activity of all species halted when thick clouds of smoke severely obscured the sun and even filled the valleys of the area.

IV. WIND DIRECTION AND VELOCITY

No general correlations with flight activity were attempted, as it was obvious that from comparing the graphs wind direction and velocity usually are independent factors not acting on butterflies to any measurable extent (July 10 being the exception with regard to wind velocity). This is likely because of the rather sheltered valley in which the Lodge meadow is located, where the winds are of a mild nature. The wind speed and direction would seemingly prove to be relevant factors in more exposed situations, such as where the habitat is located on the leeward or windward side of a peak or a steep hillside, or perhaps in an extensive, flat, arctic-alpine area where winds could sweep butterflies away if they did not become inactive during windy hours.

V. RAINFALL

Rainfall was light in the Pass during the summer of 1960, as it was for the entire state. Rain (over 0.05 inches) on July 4 eliminated any flight activity on that and the following day; likewise, nearly trace amounts of rain (with a high degree of cloudiness) on July 2, 26, 27, 30 and 31 halted all flight of butterflies. Thus a correlation between precipitation in the form of rain and butterfly activity exists; if rain occurs, there will be "no" flight activity during that time. We are, of course, limiting this conclusion to just this particular temperate zone locality. The summer rains in the Sierras are cold and accompanied by a noticeable drop in air

temperature. Precipitation is also accompanied by increasing cloudiness, a drop in barometric pressure, and an increase in relative humidity; it is felt that from this study the first two factors are the influential ones on butterfly flight activity. We already noted in the introduction that some workers have found insect abundance to be correlated with relative humidity.

D. The Interrelationships of Factors, and Statistics

The interrelationships among the meteorological factors considered in this paper are obvious. Rainfall will always be associated with degree of cloudiness, which in turn is linked with amount of solar radiation or light intensity (not measured in this study, other than very approximately by daily cloudiness). In high mountain areas, a decrease in solar radiation may be more important than temperature in influencing flight activity, as evidenced by the negative correlation of degree of cloudiness and butterfly numbers found in this study. Other relationships have been stated earlier.

The task of determining the particular factor (out of two or more conditions) responsible for affecting activity is indeed a formidable one. With butterfly activity as the dependent variable, one could determine multiple correlations for various combinations of independent meteorological variables, as Hovanitz (1948) did for certain of his data (and as we have done). But as noted above, in the Pass area the meteorological conditions are not independent of each other. One statistical method of dealing with this type of situation is the use of an equation for linear regression.

Andrewartha (1953: pp.568-583) illustrates the use of the regression equation in considering fluctuations in the numbers of a population of *Thrips imaginis* (order Thysanoptera), where weather is an important influence on numbers. The reader is referred to his book for the form and discussion of this equation, but we may mention several points here. In using the equation, the deviation from the usual number of insects is compared with the departure from the usual weather, and the extent of each condition's effect on insect numbers for any particular day is derived. This equation may be accurately used only with a large quantity of data, which our study did not provide.

E. Additional General Remarks

As noted in our discussion of temperature effects, Hovanitz found the highest period of activity of *Colias* females in the morning, with a considerable decrease in activity during the hottest portion of the day.

In the Donner Pass study area, we found the greatest activity in most species occurred between approximately 9:45 A.M. and 12:30 P.M., although because of the low population numbers we did not make an attempt to graph hourly activity during any one day HOVANITZ was able to count 1245 butterflies in 55 minutes in his Imperial Valley study).

Our suggestion for future long-term studies in areas unfamiliar to the investigator (in terms of peak flight activity) would be to record, for several days, flight activity by the hour – from as early as 6 A.M. to as late as 7 P.M. (e. g. in the tropics and during the arctic summer). Then if one is interested in fluctuations over the entire flight period of the species, he could choose from the data the normal "peak" for the species during the day, and thus obtain larger daily samples for correlation work.

It would be highly interesting to obtain additional information on the peak activity of a single species (such as *Colias*) in northern and southern localities – to discover whether it is indeed true that highest activity occurs earlier in the morning in southern localities. This phenomenon would very likely be linked with a particular level of solar radiation, for in many bird species, the morning or evening period of calling is intimately determined by a minimum and maximum level of light intensity. Such suggested studies would require exact measurements of foot-candles of light.

Additionally, comparative studies of times of high activity during the day in various species and genera would shed further light on this aspect of butterfly physiology. The senior author has observed *Cercyonis* flying at 7 A.M. in Washington state, *Caligo* and various satyrid butterflies flying only at twilight in Yucatan (Mexico), and certain Mexican *Thecla* flying only at mid-day for an hour or so. Accurate measurements of light intensity at such hours (both at the beginning and end of activity) over a number of days would undoubtedly prove of high interest. LLOYD MARTIN has pointed out that some species must fly before mating; this presents one reason for activity in the early morning hours.

SUMMARY AND CONCLUSIONS

1. The beginning of each of the flight periods of four species considered is dominated by a large "hump" of high activity, representing mass emergence of the adults over a period of up to about 10 days. Following this peak period is a long "trailing-off" period, in which individuals become progressively fewer and more worn.

2. Two different generations of one species, such as in *Colias eurytheme*, will show two distinct periods of abundance, determined

by their respective times of emergence. C. L. REMINGTON (personal communication) has pointed out that "amphidusa" is best considered a seasonal form "induced mainly by photoperiod;" if photoperiod measurements had been taken throughout the summer, the decreasing photoperiods in July and August may have nicely tied ~~in with~~ this observation of two points of abundance.

3. A five-day period of generally mild weather, coupled with high diurnal temperatures and a rise in the low nocturnal temperatures, apparently stimulated the mass emergence period of *Parnassius clodius, Chlosyne hoffmanni, Plebejus icarioides,* and *Nymphalis californica.*

4. Temperature was not found to be correlated with flight activity. This was perhaps principally because of the constantly-high diurnal temperatures throughout the greater part of the summer.

5. Relative humidity and barometric recorded under the stated conditions (5:30 P.M.), did not show any particular deviations during the early-summer peak of butterfly activity. Thus no conclusions on possible effects can be drawn. It is suggested that studies in tropical areas might elucidate the influence of these factors.

6. Degree of cloudiness, with its accompanying influence on solar radiation or light intensity, was shown to be directly correlated in a negative way with flight activity; i.e., along a line of increasing cloudiness, butterfly activity decreases. On clear, warm days, all degrees of activity occurred.

7. Butterfly activity in the Lodge meadow area was usually independent of wind direction and wind velocity.

8. Rainfall, accompanying cloudiness and barometric pressure and relative humidity changes, definitely is correlated with flight activity in a negative sense; that is, with any amount of rain, butterfly activity ceases.

9. The interrelationships of meteorological factors makes interpretation of the effect of any single factor quite difficult. Multiple-correlation graphs and the linear regression equation are two statistical methods for dealing with this type of situation.

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The authors wish to express their appreciation again to Mr. WILLIAM N. GOODALL of the National Audubon Society, Director of the Audubon Camp of California at Donner Pass (Norden, California), where full cooperation for collecting data was

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NEW SKIPPER AND BUTTERFLY RECORDS FOR SOUTHWEST LOUISIANA

by Roy O. Kendall

Over the years lepidopterists have, for some unknown reason, failed to collect in Vernon, Beauregard and Calcasieu Parishes of southwest Louisiana. This paper will record for the first time, forty species which may be found in these or adjoining parishes. Two of these species: *Pholisora catullus* (Fabricius) and *Erynnis zarucco* (Lucas) were not included in the list for Louisiana by Lambremont (1954).

Collecting was accomplished on a sampling basis during the period 1955 through 1961. Intensive collecting in this area would disclose many more species than are here recorded. The specific area in which samplings were taken is bounded on the west by the Sabine River which divides Louisiana and Texas from a point near Logansport, De Soto Parish, south to the Gulf of Mexico. Contiguous hardwood forests characterize the west boundry of the collecting area. East of the Sabine River one finds a vast amount of piney woods cut by numerous creeks or small streams which drain into the Sabine River to the west or the Calcasieu River to the east, both terminating in the Gulf of Mexico.

Arrangement of this paper follows the forthcoming Synonymic List of Nearctic Rhopalocera by Cyril F. dos Passos who kindly checked the manuscript and offered helpful suggestions. The nearest city to the locality in which each specimen was collected is recorded below. Most of the records are from DeQuincy and Lake Charles, in Calcasieu Parish, and Leesville, in Vernon Parish. By and large the specimens were found within the corporate limits of the various cities. In those instances where immature stages were reared, the larval foodplant is given.

HESPERIIDÆ

Wallengrenia otho otho (Smith). DeQuincy, 1♂, 7 Sept. 59.

Lerema accius (Smith). Leesville, 1♂, 20 Aug. 55.

Pholisora catullus (Fabricius). Leesville, 2♂♂, 20 Aug. 55.

Pyrgus communis communis (Grote). Leesville, 10♂♂, 20 Aug. 55. DeQuincy, very common 31 May and 1 June 56; two females observed 7 Sept. 59 to oviposit on *Sida* sp.; adults *ex* ovis 18 & 20 Oct. 59. Lake Charles, a number of adults seen but none taken, 7 & 8 Nov. 61.

Erynnis zarucco zarucco (Lucas). Leesville, 2♂♂, 1♀, *ex larvæ* 22-23 Sept. 59; larval foodplant *Robinia pseudoacacia* L. (see Kendall, 1960).

Lake Charles, 1♂, 1♀, *ex larvæ* 9 Dec. 61; other larvæ in diapause at present, 20 Jan. 62, larval foodplant *Sesbania exaltata* (Raf.) Cory.

Erynnis horatius (Scudder & Burgess). Leesville, 11♂♂, 2♀♀, *ex larvæ* 1 Feb. to 16 Dec. 59. Many, Sabine Parish, 2♂♂, 2♀♀, *ex larvæ* 31 Oct. to 29 Dec. 59. Lake Charles, 1♂, 2♀♀, *ex larvæ* 9 to 18 Feb. 61; larval foodplants *Quercus hemisphærica* Bartr. and *Q. nigra* L.

Achalarus lyciades (Geyer). Leesville, 1♂, 20 Aug. 55. 1♂, 30 June 57.

Epargyreus clarus (Cramer). Leesville, 3♂♂, 1♀, 20 Aug. 55; numerous larvæ found 13 Sept. 59 on *Robinia pseudoacacia* L. Larvæ also found on this plant in DeSoto Parish 15 Sept. 59 and in Union and Miller Counties, Arkansas on 16 & 17 Sept. 59.

PAPILIONIDÆ

Battus philenor philenor (Linnæus). Leesville, 1♀, 20 Aug. 55.

Papilio polyxenes asterius Stoll. Leesville, 1♂, *ex larva* 5 Apr. 59; larval foodplant *Daucus pusillus* Michx.

Papilio cresphontes cresphontes Cramer. Leesville, 1♂, 20 Aug. 55.

Papilio glaucus glaucus Linnæus. Leesville, 1♂, 20 Aug. 55.

Papilio troilus troilus Linnæus. Leesville, 2♂♂, 1♀, 20 Aug. 55.

Papilio palamedes Drury. Leesville, 1♂, 1♀, 20 Aug. 55. 1♂, 14 Sept. 59.

PIERIDÆ

Pieris rapæ (Linnæus). Many, Sabine Parish, found to be common in a city vegetable garden where its larval foodplant was growing.

Colias eurytheme eurytheme Boisduval. Lake Charles, 3♂♂, 4♀♀, *ex larvæ* 1-6 Dec. 61; larval foodplant *Sesbania exaltata* Cory.

Phœbis (*Phœbis*) *sennæ eubule* (Linnæus). Leesville, very common 20 Aug. 55, about 40 specimens taken. DeQuincy, very common 4 Sept. 59; several females observed to oviposit on *Chamæcrista cinerea* Pollard; one larva found on this plant 12 Sept. 59; 1♀, *ex larva*, 28 Sept. 59. From 13-17 Sept. 59 this insect was found to be very common in Calcasieu, Beauregard, Vernon, Sabine, DeSoto and Bossier Parishes.

Eurema (*Pyrisitia*) *lisa* Boisduval & Leconte. Leesville, very common 20 Aug. 55, more than 20 specimens taken.

Eurema (*Abæis*) *nicippe nicippe* Cramer. Leesville, 3♂♂, 2♀♀, 20 Aug. 55. Lake Charles, 4♂♂, 5♀♀, *ex larvæ* 20 Nov. to 9 Dec. 61; larvæ found on *Cassia occidentalis* L. and later transferred to *Cassia bicapsularis* L., which they readily ate, maturing in due course.

Nathalis iole Boisduval. Leesville, 1♂, 20 Aug. 55.

LYCÆNIDÆ

Strymon cecrops (Fabricius). Leesville, 1♂, 1♀, 2 June 56. DeQuincy, a good number of adults were taken 26 May 56.

Strymon melinus melinus (Hübner). Leesville, 1♂, 20 Aug. 55.

Everes comyntas comyntas (Godart). Leesville, 1♀, 2 June 56. DeQuincy, 5♂♂, 2♀♀, 31 May & 1 June 56.

NYMPHALIDÆ

Anæa andria Scudder. Leesville, 2♀♀, 20 Aug. 55; four adults *ex larvæ* 27-29 Sept. 59; larval foodplant *Croton* sp. DeQuincy, 13 Sept. 59, a number of adults were seen but none were taken.

Limenitis astyanax astyanax (Fabricius). Leesville, 1♂, 1♀, *ex larvæ* 11 & 16 June 56, larval foodplant *Salix* sp.

Limenitis archippus watsoni (dos Passos). Leesville, 2♂♂, 20 Aug. 55. DeQuincy, two adults seen but not taken on 9 & 11 Sept. 59.

Vanessa atalanta atalanta (Linnæus). Leesville, 1♂, 20 Aug. 55.

Vanessa virginiensis (Drury). Leesville, 2♂♂, 20 Aug. 55. DeQuincy, 1♂, 31 May 56; four specimens *ex larvæ,* 10 & 11 June 56, larval foodplant *Gnaphalium* sp.

Junonia cœnia cœnia (Hübner). Leesville, 1♂, 20 Aug. 55; several adults seen but not taken 25 Dec. 56. DeQuincy, 1♂, 27 Dec. 56; several others seen; also on 7 Sept. 59 a good number seen but none taken.

Polygonia interrogationis (Fabricius). Leesville, 1♂, 1♀, 20 Aug. 55.

Phyciodes (*Phyciodes*) *tharos tharos* (Drury). Leesville, 8♂♂, 7♀♀, 31 May & 1 June 56.

Melitæa (*Microtia*) *nycteis nycteis* Doubleday. Leesville, 1♀, 20 Aug. 55.

Euptoieta claudia (Cramer). Leesville, 2♂♂, 20 Aug. 55.

Agraulis vanillæ nigrior Michener. Leesville, several were seen 20 Aug. 55 but none taken. DeQuincy, ten specimens *ex pupæ* 3 to 5 Sept. 55; a good number of larvæ found 30 May 56 on *Passiflora incarnata* L. matured in due course.

SATYRIDÆ

Euptychia gemma gemma (Hübner). Leesville, 3♂♂, 20 Aug. 55.

Euptychia areolata areolata (J. E. Smith). Leesville, 1♂, 30 June 57.

Euptychia hermes sosybius (Fabricius). Leesville, 20 Aug. 55 very common, also found in good numbers 27 May 56. DeQuincy, very common 31 May 56 and 6 Sept. 59.

Euptychia cymela cymela (Cramer). Leesville, 2♂♂, 27 May 56; 1♂, 30 June 57. DeQuincy, 1♂, 31 May 56.

Cercyonis pegala pegala (Fabricius). DeQuincy, 1♂, 5 Sept. 59; 1♂, 12 Sept. 59; others were seen but could not be taken.

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A PRELIMINARY STUDY OF FOODPLANT PREFERENCES IN THE *LYCAENA HELLOIDES* COMPLEX (LYCAENIDAE) IN COLORADO

by DONALD S. CHAMBERS

I. LABORATORY STUDIES OF *helloides* – LIKE POPULATIONS

The purplish Copper of the Rocky Mountains, described from Alberta as *florus* by EDWARDS, has recently been referred to the northeastern *Lycaena dorcas* Kirby because of their very similar appearance. The range of *florus* is, however, isolated from that of *dorcas* and lies in conjunction with the area occupied, at lower altitudes at least, by *L. helloides* Boisduval, and most writers have considered *florus* to be a race of *helloides*. BROWN (1955) sees *dorcas* and *helloides* as a "well-defined cline", but CLENCH (1958) believes they are distinct species for the following reasons: first, they have different determined food-plants (*dorcas* feeds on *Potentilla, helloides* on "*Polygonum* and possibly others – but not *Potentilla*"); second, the two are sympatric but easily separable throughout a broad zone in the Michigan to Manitoba area; third, "there is no 'perfect intergraduation' across the continent as the authors state, though if large series are not seen it might appear so"; fourth, *dorcas* is single-brooded while *helloides* is multi-brooded. The present study is an attempt to determine the food plant(s) of *florus* and thereby disclose its true affinities.

An oviposition choice situation was presented to three *florus* females (Group I) collected near Gothic, Gunnison County, Colorado (elevation: 10,000 ft.). Freshly cut, roughly equal-sized sprigs from five plants were placed in moist earth in a flower pot covered by a broad lamp chimney with marquisette netting over the top. The tops of the sprigs were leveled so that all were equally accessible to the females. About three inches of open space were left below the cloth. Throughout this and the following

experiments the females were fed honey water daily and given an artificially lighted day of from ten to fourteen hours. Light and warmth were provided by an incandescent bulb placed about three inches above the cloth. With *Linum* and *Chenopodium* serving as controls, the disposition of eggs the first day was as follows:

PLANT	NO. OF EGGS	LOCATION ON PLANT
Potentilla fruticosa	16	upper leaves and stems
Rumex	33	all on flowers or fruit
Polygonum douglassii	4	not noted
Linum	0	--
Chenopodium alba	6	on fruit
On soil	2	--
	61	

After this test, Group I and two new groups of three females each were presented *Potentilla fruticosa* or *Rumex* sp. (once both) on successive days. The schedules and results were as follows:

TEST DAY		*Potentilla fruticosa*	*Rumex*
Group I	1	15	--[1]
	2*[2]	--	21
	3	12	25
	4	--	23
	5	22	--
	6	--	15
	7**	22	--
		total 71	84
		[with previous test 87	117]
Group II	1	17	--
	2	--	72
	3	0	--
	4	--	20
	5***	4	--
		total 21	92

Group III produced no eggs.

[1]-- means plant not offered this day.
[2]Each* indicates death of one female.

The 329 Gothic eggs produced no larvæ when kept at room temperature for one month followed by three months at 4.5°C and a return to room temperature. Unless all eggs were infertile or killed in the first few days (which is very unlikely), it must be assumed that they entered diapause but subsequently died.

Five females were collected 25 Aug. 1961 in Gunnison, Gunnison County (elevation 7680 ft.), on or next to *Rumex* plants growing along an irrigation ditch; these females were at least 30 yards, and probably many times that distance, from the nearest *P. fruticosa*. They laid 102 eggs when confined with *Rumex*, and 40 larvæ hatched within five days. Twenty-two larvæ were placed on *Rumex crispus* and produced 17 adults about 26 days later.

Most areas near Gothic where the females were found contained both *P. fruticosa* and polygonaceous plants, but one field surrounded by forest was apparently devoid of *P. fruticosa* although *florus* was common.

Thus, there are probably major biological differences between the Gothic and Gunnison populations. It seems certain that the Gunnison population is not a *Potentilla* feeder, and since many late-August eggs developed immediately and hatched, it is apparently at least double-brooded. It is, therefore, best referred to *L. helloides*. The Gothic population is certainly single-brooded; there is, however, some indication that, as with the Gunnison population, *Potentilla* is not the foodplant. More evidence is needed, particularly careful field observation of oviposition choice and perhaps larval survival tests on the possible plants. It may turn out that the high altitude *florus* is not referable to either *dorcas* or *helloides*.

II. A Foodplant of *Lycaena nivalis*

Two females of *Lycaena nivalis browni* Field were observed ovipositing on *Polygonum douglassii*, 7 Aug. 1961 at Gothic, Gunnison County, Colorado. A search of about thirty plants produced five additional *Lycaena* eggs.

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EXTENSION OF KNOWN RANGE OF *MITOURA HESSELI*

by Roger W. Pease, Jr.

During a recent collecting trip to New Hampshire a female of *Mitoura hesseli* Rawson & Ziegler was collected in a White Cedar (*Chamaecyparis thyoides*) bog on 19 May 1963. The collecting locality is 6 to 7 miles northeast of the Massachusetts border and can be reached by taking Route 121 north of Haverill, Mass. and making a right turn beyond Wash Pond in Hampstead, New Hampshire. The left fork is followed to the Hampstead dump on the right at a sharp turn in the road. The bog is on the left and continues to Hampstead Road. The swamp is indicated on the Haverill, N. H. – Mass. quadrangle (1956) map of the U. S. Geological Survey series of topographic maps. Only a small part of the indicated swamp contains White Cedar. There is no true eye or open water area in the bog, but there is a collecting area where the White Cedars are relatively low and openly distributed. This is the most suitable collecting site and is surrounded by dense trees and thicket on three sides. These form only a thin barrier on the side facing the road and entrance to the open area is easy and immediate about one hundred yards south of the juncture with Hampstead Road. Otherwise, the collector may have to force his way through a quarter mile of dense White Cedar. The day on which the collection was made followed a heavy rain and water was knee deep over parts of the bog. Only two specimens were seen and one caught. The captured specimen was a female which laid numerous eggs on White Cedar. These hatched and are being raised.

Besides the type locality in Lakehurst, New Jersey, and elsewhere in that state, *Mitoura hesseli* has been reported from the Blue Hills, Milton, Mass. (1 ♀, 31 May 1941, in the collection of the Carnegie Museum) and in Southern Pines, North Carolina (1 ♀, 1 ♂, 28 July 1911 in F. M. Jones collection at Peabody Museum, Yale University). A trip to the Blue Hills in spring 1962 failed to locate any specimens.

The species is associated with *Chamaecyparis thyoides,* which extends along the Atlantic Cost from southeastern Maine to northern Florida. It is improbable that if *M. hesseli* were eliminated in any of the more isolated peripheral populations, it would be re-introduced without assistance from man. The presence of such a series of isolated populations which were once part of one great continuum might offer a situation in subspeciation similar to that between oceanic islands. It is important to look for differences between the populations of *M. hesseli* at the limits of its range, but first additional material needs to be collected.

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THE LIFE HISTORY OF *HULSTINA INCONSPICUA*, A GEOMETRID MOTH FROM SOUTHERN CALIFORNIA

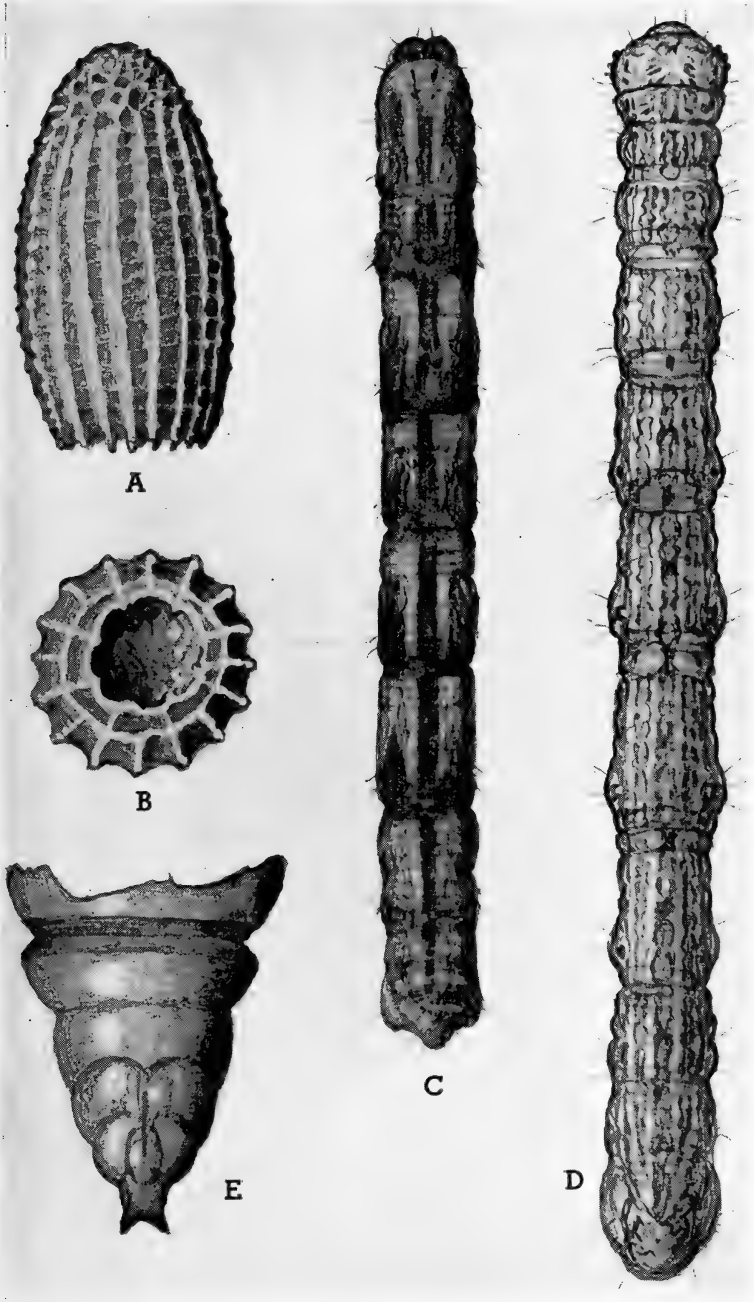
by John Adams Comstock

The inconspicuous little moth, now known as *Hulstina inconspicua* Hulst, was described in 1896 as *Chloroclystis inconspicua.* In 1908, Dyar described *Selidosema æthalodaria* from San Diego, which proved to be a synonym of *inconspicua.* Dr. J. H. McDunnough, in his "Studies in North American Cleorini, Geometridæ" (1908) illustrated the imago on Plate VII, Fig. 1, and stated that "the species is common in southern California." Apparently no descriptions or illustrations of the early stages have been published.

I reared this species from larvæ taken on *Adenostoma* in Bouquet Canyon, Los Angeles County, in June of 1937, but made no illustrations. Several gravid females taken in Del Mar at black light June 20, 1962, refused to lay in captivity on the netting or glass of the rearing jar until I placed a sprig of their foodplant in it. They then oviposited only on the plant. I also secured several larvæ by beating *Adenostoma fasciculatum* H. & A. This made possible the accompanying notes and illustrations.

EGG: Length, 0.70 mm. Greatest width, 0.35 mm. Form, elongate-oval, the base flattened and the top acutely rounded. There are from 16 to 18 prominent ridges running from the base to the micropylar area. In the upper part of the egg these coalesce and form an irregular network of hexagonal cells. There is no distinct micropyle. The longitudinal ridges are topped by pearly nodules. Fine transverse lines run from ridge to ridge. The base has a depressed central area where the ridges end in a rosette. The symmetry of this is frequently out of line as is purposely shown in our drawing, Figure B. There is some variation in the form of the egg. A few examples are somewhat elongate and subcylindrical. The eggs are at first yellow, with white ridges, but change to a pinkish or dull red as they mature.

During the time when the *H. inconspicua* eggs were hatching and running into their early instars, there were numerous other species in my laboratory requiring illustration. I was therefore unable to resume records for this species until they were nearly full grown larvæ. It was however noted that in the first instar they were apparently uniform in color, whereas in later stages they showed wide variation in color and markings.



Early stages of *Hulstina inconspicua.*

A. Egg, lateral aspect, enlarged × 90. B. Basal end of egg. C. Larva, penultimate instar, dorsal aspect, enlarged × 12. D. Mature larva, dorsal aspect, enlarged × 18. E. Caudal end of pupa, ventral surface, greatly enlarged to show cremaster.

Reproduced from water color drawing by the author.

LARVA, PENULTIMATE INSTAR: Length, 11 mm. Head width, 0.9 mm. Width of 6th body segment, 1.2 mm. Variation shows gradation from an almost immaculate yellow-green form through various darker green or brown mottled examples to the highly colored yellow and red-brown type shown in Figure C. Our description is of the latter type. Ground color of head and body, translucent greenish yellow. Head tinged with rose around the margin. Ocelli black. Each typical body segment has a wide transverse band of dull rose filling the posterior portion of the segment. Running through this band is a middorsal longitudinal stripe, which fades out on the caudal segments. There are numerous fine wavy black stripes and dashes running longitudinally on the dorsal and lateral surfaces. The venter is light yellow.

The larva is of the typical looper type, with one pair of prolegs only, in addition to the anal pair.

MATURE LARVA: Length, 18 mm. Cylindrical, the head slightly wider than the body, mottled ivory, brown and black. As in the last instar, larvæ are highly variable in color and markings, no two being exactly alike. Our description is of the darker, more contrasting type. The dorsal area is predominantly brown, with numerous black wavy lines running longitudinally in pairs. Most of these lines are interrupted in the caudal edge of each segment where a transverse yellow band occurs. These yellow bands are particularly conspicuous on the 4th to 7th segmental junctures. In the stigmatal area a wide longitudinal lemon-yellow band occurs, which is expanded on the 5th to 8th segmental junctures where large black irregular V-shaped spots are present. The legs are mottled brown and black, and the prolegs, including the anal, are yellow, mottled with brown. The spiracles are black-rimmed with yellow-brown centers. The venter is mottled light yellow and brown, with several interrupted wavy lines running longitudinally.

The mature larva is pictured on Figure D.

PUPA: Length, 10 mm. Color, wood brown, with the wing cases lighter. In form it is robust. The movable segments of the abdomen are deeply cleft. The spiracles are concolorous with the body. The cephalic end bears from ten to twelve short slightly curved brown setae. The cremaster is a quadrate protrusion ending in a pair of stout cones, with no attached hooklets. Our illustration, Figure E, shows the caudal end of the pupa on its ventral surface.

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DESCRIPTION OF A NEW SPECIES OF *CHILO* (CRAMBIDAE)

by Hahn W. Capps

The following description is to provide a name for an undescribed species, reared by Mr. R. A. Agarwal, and involved in his study of lepidopterous sugarcane pests and related species at Louisiana State University at Baton Rogue, Louisiana.

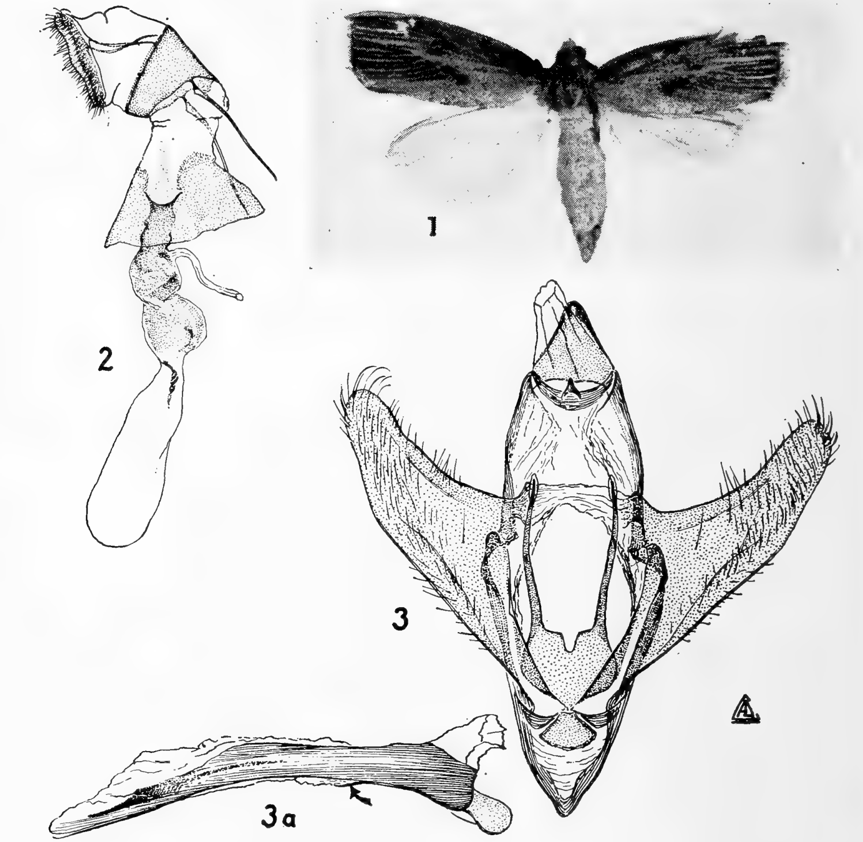
CHILO ERIANTHALIS Capps, new species
Figures 1 - 3a

Male.— Alar expanse 24 mm. Antenna simple, pubescent. Vestiture of head, collar, thorax, and patagia gray with somewhat reddish tinge, sprinkled with reddish-brown scales. Abdomen pale luteous, lightly sprinkled with dark fuscous. Labial palpus porrect, length about three times that of head; loosely scaled, gray with heavy intermixture of dark fuscous. Frons conical. Ocelli present. Forewing: Upper surface gray with slight reddish tinge, heavily dusted with fuscous; veins and folds accentuated with gray or gray with ochreous tinge, giving the wing a lined appearance; a series of conspicuous blackish metallic patches, the series chevronlike in shape with apex at outer angle of cell. Terminal dots black. Fringe cupreous, somewhat metallic. Under surface paler than above; metallic patches absent; terminal dots black but weaker than above. Hindwing: Uniformly pale gray with brownish tinge; fringe concolorous with wing, non-metallic. Hind tibia normal; two pairs of spurs, length of outer spurs about two-thirds that of inner. Genitalia (fig. 3): Harpe simple, rather broad basally, narrowed apically; uncus short, distal end a sharp point; gnathos simple, median projection a narrow upturned hook; arms of anellus long, slender, extending to or above costa of harpe. Ædeagus (fig. 3a) slender with a very narrow ventral tonguelike projection; the projection weakly sclerotized distally, short and ending well before middle of ædeagus; cornutus moderately long, spinelike.

Female (fig. 1).— Alar expanse 25-28 mm. Similar to male in color and maculation. Genitalia (fig. 2): Length of ductus bursæ about two times the width, moderately sclerotized, constricted near middle; ductus seminalis origin from or near junction of ductus bursæ and bursa copulatrix; bursa copulatrix elongate, lightly sclerotized from junction with ductus bursæ to signum, the sclerotized portion constricted near middle; signum narrow, elongate, weakly sclerotized, slightly scobinate.

TYPE.— Male, in U. S. National Museum, USNM Type No. 66663. Paratypes.— Four females, same locality as type; in U. S. National Museum. Type locality.— Port Blarre, Louisiana. Food plant.— *Erianthus* sp.

Remarks.— *Chilo erianthalis* resembles *C. fernaldalis* Dyar & Heinrich in size and habitus, but *fernaldalis* is paler, more grayish, and the forewing is unlined, lacking a conspicuous grayish accentuation on the veins and folds; dark fuscous patches are absent, or if discernible, obsolescent and non-metallic; a distinct subterminal line is present and the fringe is dull brown with a reddish tinge. The ædeagus of *fernaldalis* has the ventral tonguelike projection well developed, broader and longer than in *erianthalis,* and extending to or slightly beyond middle of ædeagus.



Figures 1 — 3a. *Chilo erianthalis,* new species. 1. Female paratype. 2. Female genitalia, ventral view. 3. Male genitalia with ædeagus removed, ventral view. 3a. Ædeagus, lateral view. Delineations of the genitalia prepared by Mr. A. D. CUSHMAN, Scientific Illustrator, Agriculture Research Service, U. S. Department of Agriculture; not drawn to scale. Photograph of adult is two times natural size.

Dates on the labels indicate emergence of *erianthalis* is in January and February. Due to poor condition of the male type, a photograph of a female paratype is used for illustration of maculation and habitus.

The female sex of *fernaldalis* has not yet been associated with the males.

The immature stages of *erianthalis* are to be treated by Mr. AGARWAL in his thesis.

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ON THE SYSTEMATIC POSITION OF THE SO-CALLED SUBFAMILY PLATYCHASMATINÆ NAKAMURA, 1956 (NOTODONTIDÆ)

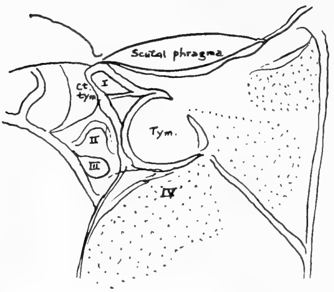
by SERGIUS G. KIRIAKOFF

NAKAMURA described (1956: 143) a new subfamily of the Notodontidæ which he called Platychasmatinæ. His text was in Japanese, and I can unfortunately only make use of the English summary which runs as follows (spelling original): "Platychasmatinae nov. Involvs Japanese *Platychasma* and Indian *Cyphanta*, charcterized by the forewing with R_2 from lower angle of cell". This statement is of course wrong because R_2 obviously is a misprint for M_2. Moreover, even if corrected, it does not explain the reason for the transfer of the noctuid genera *Platychasma* and *Cyphanta* to the Notodontidæ, since the family Noctuidæ has, among its basic characters, M_2 in the forewing arising from the lower angle of the cell, while the family Notodontidæ has that vein placed in the middle portion of the discocellulars, and sometimes even above the middle. Further, both *Platychasma* and *Cyphanta* have, in the hindwing, the characteristic basal loop or cell formed by anastomosis of 8 and the stalk of 6+7 shortly after the base, with both veins subsequently diverging, while the Notodontidæ have these veins approximated for some distance, usually almost to the end of cell.

Still more important than the basic venational features are of course the tympanic structures, and the study thereof permits us to assign the genera involved with certainty to their true place, either in the family Noctuidæ or in the family Notodontidæ.

Thanks to the kindness of D. S. FLETCHER of the British Museum (Natural History), I have been able to dissect specimens of the typical species of both genera, viz. *Platychasma virgo* Butler and *Cyphanta xanthochlora* Walker.

The results of the dissection are shown in figs. 1 and 2, so that a short comment is sufficient. Both structures are unquestionably of the noctuid type, with an oblique tympanum, without the "kettledrum" of the Notodontidæ and with the broad pocket-bearing frame. *P. virgo* (fig. 1) is peculiar in the large, double pocket I, whereas pocket IV is large but shallow. But for the much larger pocket I, it is rather similar to *Plusiodonta* (group 2 of the Erebine-Catocaline complex of RICHARDS, 1933: 17). However, its relatively narrow scutal phragma reminds one of that



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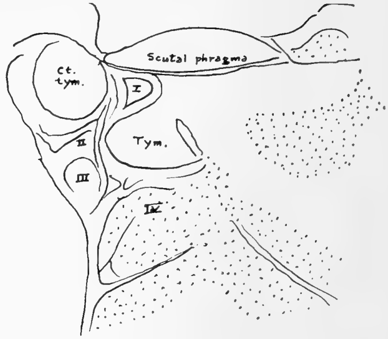

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Fig. 1. *Platychasma virgo,* tympanic structures. Fig. 2. *Cyphanta xanthochlora,* tympanic structures. See discussion in text.

of the Herminiinæ and Hypeninæ of RICHARDS. Since, however, the scutal phragma varies a great deal in individual genera, the best place for *Platychasma* seems to be in the vicinity of *Plusiodonta.*

Cyphanta xanthochlora (fig. 2) has all four pockets moderately developed, but well formed, and is on the whole similar to the "First group" of the subfamily Erastriinæ of RICHARDS (*l. c.*: 23 ff.) which, as that writer points out, differs but slightly from the "Trifid subfamilies". The latter are, however, mostly characterized by a relatively large countertympanum. In *C. xanthochlora* that structure is about of the size of the true tympanum, so that this genus should probably be placed with the subfamily Acronictinæ, where as a matter of fact it has been placed in the British Museum (Natural History). *Cyphanta* has, like *Platychasma,* a relatively narrow scutal phragma.

Both genera are most definitely noctuids, and the subfamily Platychasmatinæ should accordingly be suppressed.

The above instance shows once more the importance of the tympanic structures for the classification of the Lepidoptera.

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ABOUT THE "PUMPING ACTION" OF A *PAPILIO* AT WATER

by Walfried J. Reinthal

The phenomenon of pumping water by different Lepidoptera has been observed by entomologists in different countries, and some of their observations have been published. Clench described (*Lepid. news* 11: 18-21; 1958) his interesting observations on two species of moths "pumping at water" in the Carnegie Museum Powdermill Nature Reserve, Westmoreland County, Pennsylvania. Welling described (*Lepid. news* 12: 170-172) a similar phenomenon from Gildersleeve Mt. State Park, Lake County, Ohio, also occurring with moths, and involving some of the same species observed by Clench. Further, he described the same action by certain species of *Papilio* in Yucatán and Quintana Roo, Mexico. In the last case a large number of *Papilio epidaus* was involved.

An observation was made by this author during the late afternoon of September 2, 1961 of similar behavior of a male *Papilio glaucus*. While at a swimming pool I noticed the butterfly flying around, first low over the water, then along the pool's sidewalk. It seemed that the insect was looking for water to satisfy its thirst. After a while it alighted on a wet spot, of about three to four inches in diameter and containing no more than a few tablespoons of pool water left on the concrete sidewalk by a swimmer. As the butterfly was located only a couple of feet from the edge of the swimming pool, I was able to approach and observe it without leaving the pool. After taking a few sips of water, the insect expelled a drop of semi-clear, somewhat milky-looking fluid out of its abdomen. After sucking for some ten to fifteen seconds the butterfly started exuding water regularly from its abdomen.

Now I became more curious and began observing it very closely, and I noticed that both its head and abdomen functioned synchronically. The rate of discharging water from its anal opening was about two, occasionally only one, drop every five to ten seconds. This pumping in of the water through the proboscis and at the same time eliminating it from intestines went on uninterruptedly for about the next twenty minutes. During this interim over two hundred and fifty drops of water were counted as being eliminated at the rate mentioned above.

Nothing in particular seemed to disturb the insect. It was actually so deeply absorbed in its activity that several gusts of wind blew the butterfly over, but this did not interrupt its activity, and immediately the insect regained its position. A swimming pool guest walked by, at a distance of only two feet, and the butterfly did not pay any attention.

Although two children ran by almost striking the insect, it only flipped its wings once and went on with the sucking. Encouraged by this unperturbed attitude, I moved even closer so that my last observations were made from a distance of few inches only. If two noisy boys had not jumped out of the pool and scared away the butterfly, it seems that the above described activity of the papilionid would have continued beyond my twenty minutes of observation. Even then, it flew around for a while seemingly looking for more water, and actually sat down at another wet spot where it started sucking again. This lasted only a short while until the insect was disturbed again and flew over a fence.

The causes for this strange behavior are not fully understood, but apparently it was not only the intake of water to satisfy the insect's thirst. It appeared as if the insect had to give itself a sort of internal lavage, syphoning the water through its body, retaining none or very little and trying to eliminate with the water some waste product from its body.

The exact time of this observation was from 6:00 to 6:30 P.M. The weather was warm but not hot nor particularly humid, about 74° F. at that time, with partly cloudy skies. The observation site was a country club's large swimming pool at the city limits of Knoxville, Tennessee.

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ADDITIONAL NOTE ON FOOD PLANT OF *SPHINX KALMIAE*

In the *Journal* (vol.15: p.64; 1961) I reported a food plant of *Sphinx kalmiae* J. E. Smith to be *Diervilla lonicera*. The third of August 1961 I took a *kalmiae* from which I secured 138 eggs. The young larvae took readily to *Diervilla*. As the supply of this plant was somewhat limited, a search was made for a substitute. Fortunately I found two larvae and three eggs of *kalmiae* on what is locally known as Mountain Holly (*Nemopanthus mucronatus*) which grows commonly in the area around Hazelhurst, Wisconsin. The young larva took readily to the new food plant and in the process of supplying the food I found several larvae and eggs of *kalmiae*. I also found a larva and egg on *Diervilla lonicera*. This establishes the voluntary selection of these food plants. I have a feeling that *mucronatus* is the preferred one. The moth has a more extended period of flight than any of the other local sphingids, being on the wing from early June till the middle of September. The identity of *Nemopanthus mucronatus* was determined for me by the Milwaukee Museum through the kindness of Mr. J. R. NEIDHOEFER of Milwaukee.

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RHOPALOCERA ATTRACTED BY ULTRAVIOLET LIGHT IN CENTRAL AMERICA

by Eduardo C. Welling

Collecting for nocturnals with a single 15-watt mixed GE Black Light sometimes has its surprizes. Not only do certain Heterocera appear that ordinarily are not frequently attracted to other kinds of light but we even notice certain diurnals that make their appearance, not only Rhopalocera but other insects too. These individuals are probably not "doing the town" after hours so as to say, but probably are resting in some of the trees and shrubs nearby and consequently can not resist the light on being awakened. This is easy to observe because at certain times of the year large beetles, like *Calosoma, Phyllophaga,* etc., come quite commonly to the light, first throwing themselves heavily against anything that is in their way before falling to the ground or settling on the wall or sheet where the Black Light may be. In fact the time of year when I have found most Rhopalocera at Black Light is in the spring, when these beetles are very common. Sphinxes with their crazy confused flight may also help in shaking branches and leaves, thereby disturbing any diurnals that may be asleep among them near the light.

Here is a list of some Rhopalocera taken by Black Light during the course of 1960:

Papilio cresphontes Cram. 1♂, 1. IV, Mérida, Yucatán.
Graphium epidaus epidaus Dbld. 1♂, 14. IV, Mérida, Yucatán.
Appias ilaire Gdt. 1♀, 25. VI, Mérida, Yucatán.
Opsiphanes tamarindi Feld. 2♀♀, 1♂, 15. VII, Camp Sibun, Cayo District, British Honduras; 1♀, 12. VII, same locality.
Microtia elva Bates 1♀, 25. VI, Mérida, Yucatán.
Megaleura chiron Fabr. 1♂, VII, Camp Sibun, Cayo Dist., British Honduras.
Chlorippe pavon Latr. 1♀, 14.X., X-cán, Quintana Roo.
Historis acheronta Fabr. 1♀, 10. III, Mérida, Yucatán.
Libytheana carinenta Cram. 1♂, 25. VI; 1♂, 26. VI, Mérida, Yucatán.
"Thecla" azia Hew. 1♂, 2. IV, Mérida, Yucatán.
Calycopis sp. (*beon* group) 1♂, 1♀, 10.III; 1♂, 23. VI; 1♀, 26. VI., Mérida, Yucatán.
Callophrys herodotus Fabr. 1♂, 26. VI., Mérida, Yucatán.
Polites athenion Hbn. (=*Pompeius pompeius* Latr.) 1♀, 1. IV, Mérida, Yucatán.

Some of the *Opsiphanes* may have been normally flying around after dark, as most brassolids are usually on the wing at dawn and dusk, preferring to hide in the forest dephths during the daylight hours. It is curious to note that no *Taygetis* spp. (Satyridae) were attracted to Black Light even though many entered my rotten- banana-baited trap nets, indicating that the species were common at the time when I was using the light in Quintana Roo one fall. Species of this genus are rather common at ordinary lights in the country villages in the evening, and can frequently be seen flying around in the dusk.

Calle 66 Norte, No. 426, Mérida, Yucatán, MEXICO

R E V I E W

THE ONTOGENY OF INSECTS. Acta symposii de evolutione insectorum, Praha, 1959. 1960. 406 pp. Published by Czechosovak Academy of Sciences. Available from the Publishing house of the Czechoslovak Academy of Sciences, Vodickova 40, Praha 2, Czechoslovakia; price 43.50 Kčs.

The present book contains all papers read during a symposium on the Ontogeny of Insects in Praha 1959. In total, 80 papers are published, of which 25 more or less deal with Lepidoptera.

The symposium has five sections: 1. Morphology and anatomy of the development of insects; 2. Physiology of development; 3. Seasonal periodicity of development (diapause and hibernation); 4. Influence of biotic factors; and 5. Influence of abiotic factors on development.

All papers discussing Lepidoptera will be recorded in the "Recent literature" section of this *Journal.* In this short review I will note only a few papers with special interest for all students of Lepidoptera. These are, *e. g.*: a series of papers on *Bombyx mori, Antherea pernyi,* and related species (by L. H. FINLAYSON, V. J. NOVAK, R. S. USHATINSKAYA, A. GUBICZA, etc.); diapause in *Bupalus piniarius* in relation to host-parasite synchronization (by L. M. SCHOONHOVEN); trehalose in the development of *Celerio euphorbiae* (by I. MOCHACKA and C. PETRYSZYN); a number of papers on *Galleria mellonella;* some interesting reports on pest species (*Hyphantria cunea, Laspeyresia pomonella,* and *Scrobipalpa ocellatella*); and a number of other problems in experimental entomology.

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THE STATUS OF *MYELOIS NEOPHANES* (PHYCITINAE) IN ENGLAND

by PAUL E. S. WHALLEY

This species was described by DURRANT (1915) from the county of Dorset, England. The distribution in England is restricted to the counties of Surrey, Hampshire, Dorset, Devon and the Isle of Wight. It is usually found on heaths, sea-cliffs and pasture-land, but has been found in other situations (Beirne 1952: 107). The larva feeds on the cosmopolitan globular black fungus, *Daldinia concentrica,* which grows on birch, gorse and other plants.

While examining English specimens I noticed the similarity between the English *Myelois neophanes* and the American *Apomyelois bistriatella* (Hulst). Closer examination showed that the American species cannot be separated from the English one on external characters or on the female genitalia. Small differences were found in the male genitalia in the shape of the juxta and transtilla and in the shape of the sclerotized portion of the valve. Specimens which had been compared with the Durrant type in the British Museum (Natural History) were sent to Mr. H. W. CAPPS at the U. S. National Museum, who compared them with American specimens and confirmed my findings.

HEINRICH (1956: 42) gives the distribution of the American species as "probably throughout eastern and central United States, nowhere apparently a very abundant species".

The English species should be transferred to the genus *Apomyelois* and be placed as a subspecies of *A. bistriatella*:

Apomyelois bistriatella bistriatella (Hulst), in America

Apomyelois bistriatella neophanes (Durrant) *comb. n., stat. n.,* in England.

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Beirne, B. P., 1952. *British pyralid and plume moths.* 208 pp. Warne & Co., London.

Durrant, J. H., 1915. *Myelois neophanes* sp. n., an addition to the British list. *Ent mon. Mag.* 51: 302.

Heinrich, C., 1956. American moths of the subfamily Phycitinae. *U. S. Nat. Mus. Bull.* 207: 1-581.

British Museum (Nat. Hist.), Cromwell Road, London S. W. 7., ENGLAND

REVIEW

THE LEPIDOPTERA OF NEW YORK AND NEIGHBORING STATES. PART IV. [Agaristidae, Arctiidae, Lithosiidae (*Cisthene* by C. B. Knowlton), Nolidae (by J. G. Franclemont), Euchromiidae and the Rhopalocera (including Hesperiidae)]. By William T. M. Forbes. September 1960. 188 pages, 188 figures. Published as Memoir 371 by the Cornell University Agricultural Experiment Station of the New York State College of Agriculture, Ithaca, New York. [Price $1.75, paper covers; available from: Mailing Room, Stone Hall, Cornell University, Ithaca, N. Y., U. S. A.]

The first third of this publication, dealing with the several families of moths mentioned above, will be welcomed by eastern lepidopterists. It continues the improved style of approach evidenced in Parts II and III of this monumental work, with liberal use and illustration of genital characters, and with its careful keys and characterizations should make the task of identification in these families much easier and surer than was possible before. There are some surprises, such as: *Isia* (Arctiidae) changed to *Pyrrharctia;* the Great Leopard Moth (*Ecpantheria*) species name changed from *deflorata* to *scribonia; Lycomorpha* removed from the Euchromiidae (Amatidae, Ctenuchidae, Syntomidae) to the Lithosiidae; *Nigetia* removed from the Nolidae to the Noctuidae (Acontiinae). I am not familiar enough with the nomenclatorial background of the name changes to make intelligent comment on them, but the transfers are obviously well grounded and represent real improvement. As in earlier parts, it is a pity that illustrations could not have been provided. Colored figures, of course, would have been ideal (especially so for these aglaochromatic groups), but good half-tones would have been valuable.

The remaining two-thirds of the publication is devoted to the suborder Rhopalocera, under which are included the superfamilies Hesperioidea and Papilionoidea. This portion cannot be dismissed so easily or so favorably. In the first place, the butterflies and skippers, from the standpoint of readily available, competent and up-to-date literature, are far better off than the moths. Klots' *Field Guide,* in particular, covers the same area that Forbes does and more, provides more information — though Forbes gives more on genital characters and probably more on early stages — and an abundance of colored and half-tone illustrations. It would seem that, consistency notwithstanding, an alteration of treatment could have been made here with profit. A second point is the virtual absence of particular information on New York state. Forbes covers in this work an area extending roughly from the Carolinas north to the pole, from the Atlantic to the eastern foothills of the Rockies, yet the title specifically refers to New York. He treats, in other words, a

large number of species in addition to those definitely known from the state, yet the latter are not even specifically indicated and aside from a few rare, local or unusual species no New York localities are cited.

A third point, one I find particularly hard to understand, since Professor FORBES has always been an exponent of "the larger view" – is the inordinate space devoted to aberrations, named seasonal forms, etc.

The most striking and controversial parts of the work, however, are none of the foregoing. The chief bones of contention here are, first, FORBES' long outmoded generic conservatism and, second, his private code of nomenclature, which rejects the principle of priority in favor of the "principles" of familiarity and no ambiguity. In practice these result in such classificatory and nomenclatorial upsets as: all the hairstreaks being placed in *Thecla*, all the blues in *Plebeius*, most of the smaller skippers (*e.g., Hesperia, Poanes, Atrytone, Polites*) in *Pamphila*, *Chrysophanus* used for the coppers, *Satyrus* for *Cercyonis*, *Thanaos* for *Erynnis;* and many others, too numerous to list in detail.

It is not these practical effects which are the most worrisome, however, for after all it is doubtful that this work will exert much influence on the future course of butterfly nomenclature. Of far more concern are the theses under which they have been produced. By its very nature taxonomy is one of the freest of the sciences, with more room for personal opinion and individual judgment than most. Freedom, however, must not be mistaken for license and FORBES' treatment is perilously close to that. Especially is this true of his rejection of the International Rules. Imperfect as they are – bungling, vacillating, exasperating as they are – they still represent a collective and largely successful effort of taxonomists to prevent nomenclatorial chaos. To reject them, even with the best of intentions, is to invite anarchy.

His ultraconservatism must be disputed on other grounds. And let it be said forthwith that the fault is not by any means all with FORBES. It is a defect at least as much of taxonomy as of taxonomists that permits NABOKOV and others on one hand to divide the blues into a series of subfamilies and FORBES on the other to encompass them all in one genus. NABOKOV's system as far as it goes is self-consistent and so is FORBES'; and either would be quite acceptable were it universally applied. Both, however, are quite incompatible with current thinking and current classifications and therein lies their most serious fault; for current concepts *are* universally applied (or are striving towards that goal), and are at least as self-consistent. We shall always have our splitters and our lumpers—a division of attitude that serves nicely as an internal self-regulatory device in taxonomy—but megasplitting and megalumping are both to be eschewed as against the best interests of the science.

It would be possible to continue in this critical vein with comments on numerous specific points. Suffice it, however, to mention merely that distribution descriptions are too brief and often incomplete; that brood information in several instances inaccurate. There are a number of slips: *Trigrioides* (p.45) for *Tigrioides; Calycopis* (P.133) credited to FABRICIUS instead of to SCUDDER; *lanoraiensis* (p.132) instead of *lanoraieensis;* "*franklinii* Freeman" (p.129) instead of *lacustris* Freeman. The casual introduction (p.104) of the previously unpublished name "*luxuriosus* Reiff ms." under *cresphontes* (presumably equivalent to *pennsylvanicus* Cherm.) is really inexcusable.

Though I consider the Rhopalocera portion of this work to be in sum an unfortunate effort, this does not imply that it is without value. The larval and pupal keys will surely be of great use, and the genitalic key to "*Thanaos*" likewise. The liberal illustration of genitalic characters where they are most needed is another important and useful feature. Among these especially to be mentioned is the genitalic separation of "*Plebeius*" *melissa* and *scudderi* succinctly and neatly, something one must dig hard, deep and long to extract from the mass of detail in NABOKOV's revision of these two!

There are, further, many fascinating suggestions and hints which specialists will want to follow up: a race of "*Pamphila*" *peckius* in Arizona; specific distinctness of "*Pamphila*" *otho* and *egeremet;* a spotty and rare second brood of *Pieris virginiensis; Eurema lisa* breeding so far north as Woods Hole, Massachusetts (but does it overwinter?); the possibility that *dospassosi* is a species distinct from "*Chrysophanus*" *dorcas* and in the same group that *claytoni* may be a representative of *helloides* (both of which seem quite unlikely to me); the possibility that the late spring "form" of "*Plebeius*" *pseudargiolus* is actually a distinct and single brooded species (a definite possibility, though I believe FORBES has confused this and some other forms in his discussion, and from EDWARDS' account the putative species should be at least partially two-brooded); a curious population of "*Argynnis*" *cybele* on Crotch Id., Maine; the specific distinctness of "*Argynnis*" *lais* and *atlantis;* the almost specific distinctness of *Lethe portlandia andromacha;* the use of several unconventional characters in the subdivision of several genera. The strange bedfellows thus resulting in the hairstreaks, however, indicate that, unsupported by other data, they can sometimes lead one astray!

In resumé, the moth families form a worthy continuation of the earlier parts of this work; the portion devoted to the butterflies is largely redundant and a nomenclatorial atavism, but with some nuggets if you look for them.

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ESPECIALLY FOR FIELD COLLECTORS

(Under the supervision of FRED T. THORNE, 1360 Merritt Dr., El Cajon, Calif., U.S.A.)

I GAVE UP COLLECTING LEPIDOPTERA (FOR FORTY-FIVE MINUTES)

by SIDNEY A. HESSEL

I began intensive collecting in 1930. Each winter, all winter long, I would dream of the coming spring campaign for *Erora læta.* I surely have made upward of twenty-five trips, mostly involving over-night stays, with this butterfly my prime objective. Until this year two trips had produced three specimens. (I had also blundered into a single specimen when it was far from my mind.) This year I hit the jackpot, albeit a somewhat modest one; eight – six intended for cabinet specimens, one male with gonad separately preserved contributed to Prof. C. L. REMINGTON at Yale for chromosome study, one female retained hopefully for eggs.

This morning when I went to my lab, first to feast my eyes upon the six *læta* on the spreading board, I was simultaneously horrified and dazed. I couldn't believe what I saw. Of the six specimens the five best had the bodies entirely or partially eaten away. Of the many specimens on the boards these were the *only* ones that had been disturbed. I went through the customary routine of pinching myself. Surely this was a nightmare and I would be happy again in a moment. But it wasn't.

I had not taken any special precautions against this sort of thing as I had experienced it only twice in the last ten years and there have almost always, summer and winter, been exposed material on the boards at that location. Once in the fall it had been a cricket and once a flying squirrel that had escaped from a cage.

Then I went to the imprisoned female to observe (what else?) that she was dead and, although she had been active and feeding for several days, had laid no eggs. Of course, she was in disreputable condition. My decision to abandon such a frustrating hobby was spontaneous, *final* and *irrevocable!*

Nothing to do now but clean things up preparatory to giving everything away and forgetting this chapter of my life as quickly and completely as possible. There was always gardening, but that, too, subject to more than a little discouragement. Without enumerating all of the more or less expected disasters, does anyone else have major *turtle* trouble? You should see the unbelievable excavations they have made on several

occasions in an artificial bog and rock garden of exotic plants that were not purchased, but personally imported by my wife and me with full measure of TLC (tender, loving care) and at extreme inconvenience. They don't bother commercial items, it seems. On second thought it would be stamps. Yes, it would be stamps – no comparable harassments there! June 13, 1962 would mark an abrupt change in my life.

The next move was to dismantle the moth trap. From force of habit (I still was in a daze), I picked up each egg carton in it individually (used to afford refuges for the moths) and turned it over for examination. If I had had my wits about me I would just have dumped the whole thing in the brook. When I got down to the very bottom, which practically never produces anything anyhow, I just caught myself in time from slapping the last carton automatically (my customary procedure to knock off the "bugs" and worthless Leps. before reassembling the trap).

It took a double-take and *another* pinch to realize that it was real – a spectacular bilateral gynandromorph *Automeris io!* Besides *læta,* this had been one of my dreams over the years. So, – a second monumental decision, this, too, spontaneous, *final* and *irrevocable!* I continue to collect Leps. After all, 1963 is another year to plan for *Erora læta,* but what year can one make plans to capture a gynandromorph *A. io????*

Since I do not expect to take another gynandrous *io* (soon), a description and photo and discussion of this one are now being prepared for publication. Any papers on *læta* can wait for next year's findings.

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RECORD CHARTS FOR THE COLLECTOR OF LEPIDOPTERA

by RICHARD HEITZMAN

For the past six years I have been using a method of correlating my observations on the occurrence and habits of Lepidoptera found in this area. It has occurred to me that this method might be of interest to other members of the Society. So with this thought in mind I would like to present it at this time.

I keep a note book of all observations and captures and every month I transfer the data to two types of record charts. After a few years the flight period of different broods becomes quite clear for many of the species. Certain of the more difficult ones still remain rather vague but at least a little understanding is gained from the results. The most

Species *Melitaea nycteis*, Doubleday

	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPT.	OCT.	NOV.	DEC.
1956						1	9, 20, 28	18, 23				
1957						2, 8, 16	27, 28	2, 5, 10, 15, 16, 19, 21				
1958					29, 31	2, 6, 7, 15, 20, 22		2, 4, 9, 10, 13, 14, 17, 19, 21	27			
1959					28, 30	2, 3, 4, 7, 8, 9, 10, 11, 12, 21	24, 27, 30, 31	2, 3, 8, 10, 13, 17				
1960						1, 3, 4, 7, 8, 9, 10, 11, 14, 15, 16, 17, 19, 20, 22, 23, 24, 25, 26, 27, 29	29	4, 6, 8, 9, 10, 11, 15, 16, 18, 19, 21, 23, 25, 26, 27				
1961						3, 5, 6, 8, 9, 13, 15, 16, 17, 18, 20, 22, 24		6, 11, 15				
1962												

Year	Occurrence	Locals
1956	Uncommon	
1957	very common	
1958	common	
1959	uncommon	
1960	common	
1961	uncommon	
1962		

Area Covered The Eastern third of Kansas and the Western half of Missouri between 38 and 40 degrees latitude.

difficult species are those whose annual resurgence of numbers is due to more than one source. An example of such for this area would be *Colias* (*Zerene*) *cesonia* Stoll. Every year a few individuals hibernate in this region, the numbers depending on the severity of the winter. These specimens are of the fall form ("rosa") which occurs from late September until the end of the season. In early to mid-May a few brilliant fresh specimens appear that have survived the winter as pupæ. Then in late May and on into June numbers of large, pale, usually worn migrating specimens arrive from more southern areas. These three different groups are easily separated themselves, but the offspring that they produce are next to impossible to separate. Most species, however, are far less complex, and a few years of observations in one general area give a very clear picture of flight periods and number of broods of most species.

I use the date chart like a calendar but run the dates up and down to give a clearer picture of flight periods. I use a different color for each brood or designation, such as blue for hibernators, red for the first brood, green for the second brood, and black for undetermined specimens. I also record the type of season, numbers-wise, that the species had; for example, "very numerous", "scarce", "unobserved", etc. Collectors who live in areas of very different climatic or elevation differences might find it preferable to keep different charts for each area.

The second chart that I use is for all the little things that one sees and usually forgets if not recorded. I only record information that pertains to the species as it occurs in my own area. Several observant

Species *Melitaea nycteis, Doubleday*

Area Covered *The Eastern third of Kansas and the Western half of Missouri between 38 and 40 degrees latitude.*

Miscellany

Habits *A wide ranging species which prefers brushy areas on small clearings in wooded areas. Often observed resting along roadways in the woods and along creek beds.*

Attractions *Often taken at moist places along roadsides and creek beds.*
Flowers visited — Zinnia, Buddleia, Apocynum cannabinum, Asclepias tuberosa*, Asclepias incarnata, Pluchia camphorata, Veronia, Rhus glabra, Melilotus albus,* Echinacea pallida,*

** prefered*

Broods *# 1 — normally late May to the end of June.*
 # 2 — late July to late August.
 # 3 — a fresh male collected in late September suggests the possibility of a partial third brood.

Host Plants *Several species of Asters found in wooded areas.*

Larvae *The larvae quite black and spiny resembles that of Melitaea gorgone carlota. It feeds openly in the daytime on the top side of the leaves. Gregarious at first the larvae soon disperse over neighboring plants.*

collectors over the country keeping such records could add a great amount of knowledge to our present understanding of the Lepidoptera. I would be interested in hearing from anyone interested in this subject. A sample of each data sheet accompanies this article.

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SERGIUSZ TOLL (1893-1961)

On the 19th of September, 1961, Professor Dr. SERGIUSZ TOLL died unexpectedly and prematurely at an age of 68. He was the great Polish authority on the systematics and taxonomy of the Microlepidoptera, in particular of the family Eupistidæ (or Coleophoridæ), of which he was a well-known specialist. He died in the hospital of his town, Katowice, of heart failure after a minor operation. His decease is a serious loss to lepidopterology.

SERGIUSZ TOLL was born on the 22nd of November, 1893, in Warsaw. He attended and finished the high school of his native town and then went to the University of Rostov on the Don, in Southeast European Russia. He studied biology and received his doctor of science degree there.

From his childhood he had been greatly attracted by natural history. As a boy he had a small zoo of his own, rearing young birds, goldfish, squirrels, etc. Very early and with remarkable success he started collecting Lepidoptera, already at the high school age possessing a collection of over 10,000 specimens. As a university student he continued his study in earnest. A collection of Lepidoptera from the environment of Rostov was donated by him to the municipal museum of that town, numbering over 40,000 specimens.

In 1924 Dr. TOLL returned to his native country and settled in the town of Bydgoszcz, where he was married and where his only child, a daughter – now a doctor of medicine, a pediatrician, – was born. Again TOLL continued the collecting and study of the Lepidoptera. From that time date his first scientific publications. His bibliography (which is published in the *Zeitschrift der Wiener ent. Verein*) contains 87 titles. In total he described about 270 new species and forms of Lepidoptera.

He was also interested in the study of birds and left a collection of birds' eggs, comprising over 12,000 pieces, dating from his time in Bydgoszcz.

In 1934 the family moved to Katowice in Upper Silesia. With great energy TOLL continued his lepidopterological studies and dedicated to them all his time. His wife helped him with the rearing of material.

Dr. TOLL was a talented and zealous taxonomist with a keen eye for subtle specific differences. This may be the reason why he selected as his specialty the study of a difficult group, the family Eupistidæ or Coleophoridæ, comprising numerous species all over the world. He was an excellent draftsman. His richly and beautifully illustrated papers give evidence of great accuracy and taxonomic insight. His figures of the male genitalia of the species are somewhat schematized, but he put in them all the important characters. His 1952 monographic treatise of the Polish Eupistidæ is a standard work of great value.

Two other publications may be mentioned as examples of TOLL's very keen ability of discrimination: "Drei weitere neue Arten der Familie Tortricidæ aus Polen" (*Ann. Zool. Warszawa*, vol.17; 1958), in which *Bactra gozmanyana* Toll is separated, and "Studies on species of the Lepidoptera of the group *Cacœcia podana* Scop. and *Pyrausta sanguinalis* L.", where the difficult *podana* group is excellently analyzed.

During the last years his interest was more and more attracted by the fauna of some of the fascinating peripheral lands of the Palearctic region: Siberia, Persia, North Africa. Alas, his untimely death put a stop to his fertile activity.

TOLL leaves an excellent collection of Lepidoptera, certainly the best one of the Polish fauna and of many other regions, comprising over

100,000 specimens. Probably the Polish Academy of Sciences will take over and deposit the collection in the Warsaw Museum. Also he left a completed manuscript of a monograph of the Eupistidæ, on which he had worked for 25 years. Mrs. TOLL informs me that the Academy is also going to publish this great work, which is a good news. The publication will be eagerly anticipated by everybody interested in the group.

The names of TOLL's teachers did not reach us. But he had many pupils. Among them are several whose names are well-known to microlepidopterists: T. RIDL, I. RAZOWSKI, S. BLESZYNSKI, and others so that it appears that he created a native school of microlepidopterology in Poland.

Of his public scientific activities the following list of posts bears witness. TOLL was President of the Bytom Division of the Polish Gornoslaski Entomological Society, former board member of the Polish Academy of Sciences at Krakow, former board member of the Gornoslaski Museum at Bytom, member of the board of the Zoological Institute PAN in Warsaw and Krakow, and member of the international editorial commission of the publishing of *Microlepidoptera Palaearctica.*

Our sincere sympathy goes to his wife and daughter.

A. DIAKONOFF

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The cover figure for Volume 17 is by JEANNE E. REMINGTON. It emphasizes stylized scales and the maxillary proboscis and labial palpi typical of adult Lepidoptera.

RECENT LITERATURE ON LEPIDOPTERA

Under this heading are included abstracts of papers and books of interest to lepidopterists. The world's literature is searched systematically, and it is intended that every work on Lepidoptera published after 1946 will be noticed here; omissions of papers more than 3 or 4 years old should be called to Dr. BELLINGER's attention. New genera and higher categories are shown in CAPITALS, new species and subspecies are noted, with type localities if given in print. Larval foodplants are usually listed. Critical comments by abstractors may be made. Papers of only local interest and papers from this *Journal* are listed without abstract. Readers, not in North America, interested in assisting with this very large task, are invited to write Dr. P. F. BELLINGER (Dept. of Natural Sciences, San Fernando Valley State College, Northridge, Calif., U. S. A.). Abstractors' initials are as follows:

[P.B.] – P. F. BELLINGER
[I.C.] – I. F. B. COMMON
[W.C.] – W. C. COOK
[A.D.] – A. DIAKONOFF
[W.H.] – W. HACKMAN
[T.I.] – TARO IWASE
[J.M.] – J. MOUCHA
[E.M.] – E. G. MUNROE
[N.O.] – N. S. OBRAZTSOV
[C.R.] – C. L. REMINGTON
[J.T.] – J. W. TILDEN
[P.V.] – P. E. L. VIETTE

B. SYSTEMATICS AND NOMENCLATURE

de Toulgoet, H., "Arctiides nouveaux de Madagascar et de l'Île Maurice" [in French]. *Mém. Inst. scient. Madagascar, ser. E.* vol.5: pp.169-217, 2 pls., 27 figs. 1954. Description of new spp. of arctiids from Madagascar and one from Mauritius: *Rœselia nanula* (Maroantsetra), *R. costisquamosa* (same), *R. biangulata* (Ankaratra Mt.), *R. venustula* (same), *R. heterocosta* (same), *R. mediofracta* (same); *Nola parmelia* (same); *Eilema tristis* (same), *E. lividula* (saame), *E. leucanicula* (Maroantsetra), *E. vicinula* (Ankaratra Mt.), *E. purpureotincta* (same), *E. carbunculosa* (same), *E. sabulosula* (Maroantsetra), *E. obtusoides* (Tananarive), *E. ankaratræ* (Ankaratra Mt.), *E. tortrix* (Maroantsetra), *E. viettei* (Mauritius), *E. trispilota pulvigera* (Tananarive), *E. punctistriata instabilis* (Ankaratra Mt.), *E. kingdoni monticola* (same); *Chionaema pauliani* (same); *Philenora falcata* (same), *P. olivascens* (same), *P. lichenaria* (same), *P. herbuloti* (same), *P. perlucida* (same), *P. flavicapilla* (same), *P. bilineata* (same); *Nolosia griseovariegata* (same); *Siccia decolorata* (same); *Diacrisia luteoradians* (same), *D. viettei* (same), *D. milloti* (Tananarive), *D. cellularis* (Maroantsetra); *Digama malgassica* (Ankaratra Mt.). [P. V.]

de Toulgoet, H., "Description d'arctiides nouvelles de Madagascar, Lepidoptera, neuvième note" [in French]. *Bull. Acad. malgache,* n.s., vol.35: pp.79-88, 1 pl., 7 figs. "1957" [1959]. Description of new species of *Phryganopteryx,* an endemic genus of arctiids in Madagascar: *P. occidentalis* (Andobo, Antsingy forest), *P. convergens* (Anosibe, Sandrangato forest), *P. griveaudi* (Ankarafantsika), *P. formosa* (Didy), *P. rothshcildi* (Perinet, Analamazoatra forest), *P. nebulosa* (same), *P. sogai* (Integral Natural Reserve no.3), *P. triangularis* (Ankarafantsika). [P. V.]

de Toulgoet, H., "Description d'arctiides nouvelles de Madagascar (10e note) (Lep.)" [in French]. *Ann. Soc. ent. France,* vol.128: pp.121-140, 23 figs., 1 pl. 1959. Description of new genera & spp. from Madagascar: *VIETTESIA* (type *Coracia plumicornis* Butler), *V. hampsoni* (Perinet), *V. proxima* (same), *V. incerta* (same), *V. multistrigata* (Ambatondrazaka), *V. æqualis* (Perinet), *V. modesta* (same), *V. viettei* (Ankaratra Mts.), *V. bimaculosa* (Perinet), *V. ornatrix* (Fanovano), *V. lucida* (Perinet), *V. virginalis* (Ampitameloka), *V. transversa* (same), *V. bella* (Betsileo country), *V. tristis* (Anosibe), *V. luctuosa* (Ampolomita), *V. perroti* (Madagascar), *V. infuscata* (Tananarive), *V. erastroides* (Ifanadiana), *V. rufibasis* (Perinet), *V. brunneomixta* (Betsileo country), *V. unipuncta* (Ampolomita); *PROXHYLE* (type *Asura vadoni* Toulgoet), *P. cinerascens* (Perinet), *P. comoreana* (Comoro, Mayotte). [P. V.]

de Toulgoet, H., "Description d'arctiides nouvelles de Madagascar (Lepid.) (11e note)" [in French]. *Naturaliste malgache,* vol.11: pp.111-121, 6 figs., 1 pl. "1959" [1960]. Descriptions of new arctiids from Madagascar: *Agylla madagascariensis* (Didy forest); *Eilema griveaudi* (Anosibe road), *E. suspecta* (Integral Natural Reserve no.3), *E. fulminans* (Ampolomita), *E. cohabitans* (Antsingy forest), *E. iluopsis* (Perinet), *E. hampsoni* (Integral Natural Reserve no.3), *E. notifera antifera antsalova* (Antsingy forest), *E. argentea infuscata* (Antsingy forest), *E. obtusoides sakalava* (Antsingy forest). [P. V.]

de Toulgoet, H., "Description d'une nouvelle arctiide marocaine: *Eilema rungsi* n.sp. (Lep. Lithosiidæ)" [in French]. *Bull. Soc. ent. Frence,* vol.65: pp.48-49, 2 figs. 1960. Description of *E. rungsi* from Morocco: Merdja Bokka. [P. V.]

Tremewan, W. G., "Notes on species of the genus *Zygæna* Fabricius." *Ent. Gazette,* vol.9: pp.183-185. 1958. Describes as new *Z pudpuralis pseudodiaphana* (Karacabey, Brussa, Asia Minor). Lectotypes are selected for some races of *Z. diaphana, Z. palustris,* & *Z. trifolii,* with some new synonymy. Regards *Z. pimpinellæ* as a race of *Z. diaphana.* [P. B.]

Tremewan, W. G., "Notes on the British species of the genus *Zygæna* Fabricius." *Ent. Gazette,* vol.9: pp.187-196. 1958. Describes as new *Z. purpuralis segontii* (Abersoch, Wales); also a "f. loc." Notes on identity of British races of *purpuralis, exulans, loti, viciæ, filipendulæ, loniceræ,* & *trifolii,* with some new synonymy. [P. B.]

Tremewan, W. G., "A new genus for *Zygæna simonyi* Rebel, Lepidoptera, Zygænidæ." *Entomologist,* vol.92: pp.213-217, 4 figs. 1959. Describes as new *REISSITA* (type *simonyi*), *R. s. yemenicola* (Jebel Masnah, 8,400 ft., Yemen). *R. sylviæ* (same locality). [P. B.]

Tremewan, W. G., "*Procris globulariæ* Hübner: an historical note and the provision of a neotype." *Entomologist,* vol.92: pp.116-119, 1 pl. 1959. Discusses taxonomic history & synonymy of this sp. & related spp. Neotype, figured, is in the British Museum. [P. B.]

Tremewan, W. G., "Two new species of Chalcosiinæ from India (Lep.; Zygænidæ)." *Entomologist,* vol.92: pp.254-256, 4 figs. 1959. Describes as new *Hampsonia bifasciata* (Tudah, near Darjeeling, 5000 ft.); *Soritia sevastoploi* (same). [P. B.]

Tremewan, W. G., "Additional notes on the British species of the genus *Zygæna* Fabricius (Lep., Zygænidæ)." *Ent. Gazette,* vol.11: pp.185-194. 1960. Describes as new Z. *filipendulæ anglicola* (Tring, Hertfordshire), Z. *loniceræ insularis* (Armagh, Ireland). Survey of some British races and local populations. [P. B.]

Tremewan, W. G., "The British species of the genus *Procris* Fabricius (Lep., Zygænidæ)." *Ent. Gazette,* vol.12: pp.19-23, 2 pls. 1961. Describes *P. statices, P. geryon,* & *P. globulariæ,* their variation, & their biology; figures genitalia & ♂ antennæ. [P. B.]

Van Emden, F. I., "The taxonomic significance of the characters of immature insects." *Annual Rev. Ent.,* vol.2: pp.91-106. 1957. Review includes some references to Lepidoptera. [P. B.]

Van Son, G., "A new African genus of the subfamily Satyrinæ." *Lepid. News,* vol.12: p.6. 1958. Describes as new *CŒNYROPSIS* (type *Satyrus natalii*).

Varin, G., "Les races françaises, ibériques et nord-africaines de *Chazara briseis* L. et leur repartition" [in French]. *Bull. Soc. ent. Mulhouse,* 1958: pp.33-39. Study of the subspecies (called "races" by the author) of the satyrid *C. briseis* in France, Spain, and N. Africa. Description of the following new subspecies: *C. b. variabilis* (France, Seine-et-Oise, Saclas), *C. b. pictonica* (France, Charente-Maritime, Royan), *C. b. peimica* (France, Allier, Mont de la Madeleine), *C. b. peimicameridionalis* (France, Hautes-Alpes, La Bessée-sur-Durance). [P. V.]

Varin, G., "Les races françaises, ibériques et nord-africaines d'*Hipparchia fidia* L. (sous-genre *Pseudotergumia* et leur répartition" [in French]. *Bull. mens. Soc. linn. Lyon,* vol.27: pp.209-215. 1958. Note on the distribution of the subspecies

of this satyrid in France, Spain, and North Africa. The author uses the incorrect term "races" and, again, the unacceptable and incorrect subspecific name *beni M'Guildi* (sic!). Describes as new *H. f. splendum* (SE France, Var, Les Arcs). [P. V.]

Varin, G., "Contribution à l'étude des Satyridae (lépidoptères). *Hipparchia semele* L. et *Hipparchia aristeus* Bonelli, leurs sous-espèces et leur répartition en France et en Afrique du Nord" [in French]. *Bull. Soc. ent. Mulhouse, 1960*: pp.13-17. List, description, & distribution of the subspecies of the satyrids *H. semele* & *H. aristeus* in France and North Africa. In the introduction, the author explains the usage of the term "race" in his earlier papers. In this paper he has interpreted badly the decisions of the International Congress of Zoology, 1958, and in regard to the Colloquiums it is only the meetings of the Entomological Society of France in 1959. [P. V.]

Viette, P., "Contribution à l'étude des Hepialidæ (dixieme note). Hepialidæ du Congo belge et du Territoire du Tanganyika" [in French]. *Rev. Zool. Bot. africianes*, vol.42: pp.201-206, 2 figs. 1949. Describes as new *Dalaca zernyi* (Haut Pays Matengo, WSW de Songea, Mbinga, 1300-1400 m., Tanganyika); *Gorgopis tanganyikaensis* (WSW de Songea, Ugano, 1500-1700 m., Tanganyika). Records of 4 other spp. with some descriptive notes & synonymy. [P. B.]

Viette, P., "Description d'une nouvelle espèce de Pyralididæ malgache" [in French]. *Mém. Inst. scient. Madagascar, ser. A,* vol.3: pp.117-119, 2 figs. 1949. Describes as new *Ulotrichodes milloti* (Tananarive). [P. V.]

Viette, P., "Description d'une nouvelle espece de Noctuidæ Catocalinæ" [in French]. *Naturaliste malgache,* vol.2: pp.47-49, 4 figs. 1950. *Miniophyllodes catalai,* a new species from Madagascar. [P. V.]

Viette, P., "Contribution à l'étude des Cossidæ (première note). Les Cossidæ de Madagascar (lépidoptères)" [in French]. *Naturaliste malgache,* vol.3: pp.133-138, 1 pl., 1 fig. 1951. A list of all Cossidæ known from Madagascar, with new synonymies, location, by the study of the types, and type localities is given. *Phragmatœcia grandis* (E. Madagascar) is described as new. A new name is given for an Australian genus: *ZYGANISUS* new name for *Pseudocossus* Gaede (preoccupied). [P. V.]

Viette, P., "Notes sur quelques lépidoptères malgaches" [in French]. *Mém. Inst. scient. Madagascar, ser. A,* vol.5: pp.131-138, 9 figs. 1951. Notes on some Lepidoptera from Madagascar. Describes as new: (Lithocolletidæ) *Lithocolletis lemarchandi* (Tananarive); *Parectopa eugeniella* (Tananarive); (Schrecksteiniidæ) *Stathmopoda clarkei* (Front Dauphin, central Madagascar); (Limacodidæ) *PSEUDOLIMACODES,* & type *P. brunnea* (Tananarive); (Noctuidæ) *Calesia tamsi* (Tananarive). [P. V.]

Viette, P., "Microlépidoptères malgaches nouveaux ou peu connus" [in French]. *Mém. Inst. scient. Madagascar, ser. E,* vol.1: pp.153-163, 13 figs. 1952. New or little known Microlepidoptera from Madagascar. Describes as new: (Tineidæ) *EUAGOPHLEPS,* & type *E. brunneis* (E. Madagascar. Vohilava), *E. lambomakandro* (S. Madagascar, Lambomakandro); *RANOHIRA,* & type *R. silvestris* (Lambomakandro); (Xylorictidæ) *PARACYPS,* & type *P. waterloti* (Tananarive); *PSEUDOPROCOMETIS,* & type *P. helle* (Lambomakandro); (Ethmiidæ) *Ethmia bradleyi* (N. Madagascar, Diego Suarez), *E. albilineata* (Diego Suarez). [P. V.]

Viette, P., "Descriptions de nouveaux macro-hétérocères malgaches" [in French]. *Mém. Inst. scient. Madagascar, ser. E,* vol.5: pp.67-80, 2 pls. 1954. Description of new malgassian Macroheterocera: (Cossidæ) *Xylocossus cretacea ambahona* (Ankaratra Mt.); (Thyrididæ) *Chrysotypus mabilleanum* (Ankaratra Mt.); *Proterozeuxis superba* (Ankarampotsy); *METATHYRIDA,* & type *M. catalaianus* (Ankarampotsy); (Agaristidæ): *Arrothia guenéianum* (Ankarafantsika); (Notodontidæ): *Scalmicauda kodamire* (Ankaratra Mt.); *Desmecræra*

toulgoetianum (Vohilava), *D. antiopa* (Tananarive); *Rhenea isaka* (Fort Dauphin); *Amphiphalera jeannelianum* (Diego Suarez); *Zelomera imitans ankaratrensis* (Ankaratra Mt.); *Fentonina io* (Ankarampotsy); *Atrasana brunneis* (Ankarampotsy); *Dinara descarpentrianum* (Tananarive); *Anticyra grandidieranum* (Diego Suarez); *Trotonotus catalaiella* (Perinet), *T. laurençonia* (Tananarive); (Drepanidæ) *Spidia vohilava* (Vohilava); (Saturniidæ) *Tagoropsis ankaratra* (Ankaratra). [P. V.]

Viette, P., "Description de nouveaux tinéides malgaches (lépidoptères)" [in French]. *Mem. Inst. scient. Madagascar, ser. E,* vol.5: pp.1-38, 37 figs. 1954. Description of new Microlepidoptera from Madagascar: (Incurvariidæ): *Nemophora janineæ* (Antongil Bay), *N. tsaratanana* (Tsaratanana Mt.); (Tineidæ) *Melasina seyrigiella* (Bekily), *M. alluaudiella* (Namoroka); *Monachoptilas stempfferiella* (Ankaratra Mt.), *M. petitiella* (Tananarive), *M. berista* (Ankaratra Mt.); *PROTAGOPHLEPS,* & type *P. masoala* (Maroantsetra); (Hyponomeutidæ) *Trichocera decaryanum* (Ambovombe); (Schrecksteiniidæ) *Stathmopoda maisongossiella* (Maroantsetra), *S. vadoniella* (Maronatsetra); (Xylorictidæ) *MOCQUERYSIELLA,* & type *M. albicosta* (Antongil Bay), *M. bourginella* (Maroantsetra); *MNAROLITIA,* & type *M. paulianellum* (Morafénobé); *HERBULOTIANA,* & type *H. abceda* (Antongil Bay), *H. benoistella* (Antongil Bay), *H. rungsella* (Maroantsetra), *H. bicolorata* (Antongil Bay), *H. violacea* (Antongil Bay), *H. catalaella* (Maroantsetra), *H. paulianella* (Ambodivoangy), *H. bernardiiella* (Ambodivoangy), *H. longifascia* (Antongil Bay); (Œcophoridæ) *RHOZALE,* & type *R. aurea* (Antongil Bay), *R. subnivea* (Antongil Bay); *Cryptolechia toulgoetianum* (Ambovombe); *ABYCHODES,* & type *A. janineæ* (Maroantsetra); *Xheroctys jeannelliella* (Maroantsetra); (Cosmopterygidæ) *Stagmatophora chopardella* (Tananarive); (Gelechiidæ) *Symbatica heimella* (Tananarive); *Polyhymno millotiella* (Morafénobé); *Idiopteryx marionella* (Morafénobé), *I. descarpentriesella* (Maroantsetra). [P. V.]

Viette, P., "Les types des lépidoptères hétérocères malgaches de Mabille se trouvant au Muséum national, Paris" [in French]. *Mem. Inst. scient. Madagascar, ser. E,* vol.5: pp.377-387. 1954. List of Mabille's types of Madagascar species belonging to the National Collection of the Paris Museum. [P. V.]

Viette, Pierre E. L., "Etude des types de microlépidoptères (Tineidæ sll.) malgaches de Meyrick du Muséum de Vienne" [in French]. *Ann. naturhist. Mus. Wien,* vol.60: pp.279-286, 1 pl. 1955. Describes as new *Metachanda phalarodora* (Madagascar). Discusses 13 other spp. (Tineidæ, Coleophoridæ, Xylorictidæ, Œcophoridæ, Gelechiidæ) described by Meyrick from Madagascar; describes ♂ genitalia of most; selects some neotypes. [P. B.]

Viette, P., "Hesperiidæ" [in French]. *Faune de Madagascar,* vol.3: 85 pp., 92 figs. 1956. A fauna of the hesperiids from Madagascar and the Comoro Islands. Keys and descriptions of the spp. & sspp.; *Fulda corollei australis* is described as new. (Androy, Ifotaka). [P. V.]

Viette, P., "Descriptions de nouvelles sous-espèces des genres *Callicore* et *Perisama* (Lep. Nymphalidæ)" [in French]. *Bull. mens. Soc. linn. Lyon,* vol.27: pp.293-296. 1958. Descriptions of new sspp. of these genera in the collection of Mme. C. Fournier de Horrack in the Paris Museum: *C. clymena colombiana* (Cañon de Tolima, Colombian central Cordillera, 1700 m.), *C. marchalii septentrionalis* (Lino, Panama, 800 m.), *C. gabaza intermedia* (Venezuela, env. de Merida), *P. euriclea marginepunctata* (central Peru, Chanchamayo), *P. lucrezia unicolor* (Venezuela), *P. calamis ochracea* (Chanchamayo), *P. maronina meridionalis* (Bolivia, Coroico, 1200 m.), *P. bonplandii venezuelana* (Venezuela, Mucuchachi). [P. V.]

Viette, P., "Descriptions préliminaires de nouvelles espèces de noctuelles de Madagascar, I (Lep. Noctuidæ)" [in French]. *Bull. Soc. ent. France,* vol.62: pp.270-279. "1957" [1958]. Preliminary descriptions of new species of noctuids from Madagascar: *Timora prochaskai* (Betioky-Sud); *Cucullia malagassa* (Perinet), *C. aplana* (Perinet); *Amphia gigantea* (Ambatolampy); *Neostichtis ignorata* (Integral

Natural Reserve No.3); *Perigea zebrina* (Lakto), *P. probata* (Sandrangato); *Calpiformis magnifica* (Perinet); *Appana subrosacea* (Ankaratra Mts.); *Hadenella thermodesa* (Anosibe); *Athetis siccata* (Didy), *A. trixysta* (Sandrangato), *A. fragosa* (Tsianovoha), *A. cryptisirius* (Didy), *A. despecta* (Perinet), *A. calypta* (Didy), *A. sicaria* (Mahatsinjo); *Elyptron berioi* (Ankaratra Mts.). [P. V.]

Viette, P., "Descriptions préliminaires de nouvelles espèces de noctuelles de Madagascar, II (Lep. Noctuidæ)" [in French]. *Bull. Soc. ent. France,* vol.63: pp.146-152. 1958. Preliminary descriptions of new noctuids from Madagascar: (Noctuinæ) *Agrotis radama* (Tananarive), *A. longidentifera ranavalo* (Tananarive); *Ochropleura elevata* (Ankaratra Mts.); *Mentaxya trisellata* (Ankaratra Mts.), *M. sexalata* (Betsileo land); (Heliothidinæ) *Timora epimethea* (Fianarantsao area); (Amphipyrinæ) *Paracaroides pauliani* (Morondava area), *P. janineæ* (Ankarafantsika); (Euteliinæ) *Pacidara splendissima* (Integral Natural Reserve No.3), *P. dinota* (Lakato area); *Phlegetonia subviolescens* (Ankarafantsika); *Eutelia histrio occidentalis* (Lambomakandro), *E. vadoni* (Maroantsetra area). [P. V.]

Viette, P., "Le Colloque international sur la Nomenclature zoologique" [in French]. *Lambillionea,* vol.58: pp.76-81. 1958. Considerations on the Colloquium on Zoological Nomenclature, London 1958. [P. V.]

Viette, P., "Lépidoptères récoltés à La Réunion par R. Richard, I-II 1957" [in French]. *Lambillionea,* vol.58: pp.37-44, 2 figs. 1958. Describes as new (Noctuidæ) *Agrotis alluaudi* & *Blenina richardi* (Plaine des Cafres, Réunion). Places *palmistarum* Joannis in *Mentaxya,* which is distinct from *Scotia* (=*Agrotis* Ochs., *nec* Hb.). List of spp. (Pyralidæ, Geometridæ, Noctuidæ, Lithosiidæ, Hesperiidæ). [P. B.]

Viette, Pierre, "Lépidoptères tinéides (s.l.) et pyrales. Resultats de l'expedition zoologique du Professeur Dr. Håkan Lindberg aux îles du Cap Vert durant l'hiver 1953-54, No. 18" [in French]. *Comm. biol.,* vol.17, no.8: 12 pp., 3 figs. 1958. Describes as new *Ethmia paneliusella* (S. Nicolau); *Eudoria lindbergalis* (S. Antão); *Euclasta defamatalis insularis* (S. Antão); and *Cynæda dentalis occidentalis* (S. Antão). Records of 21 further species, mainly Pyraustidæ, are given. [W. H.]

Viette, P., "Note sur de petites collections de lépidoptères récoltès aux îles Comores et en Aldabra" [in French]. *Lambillionea,* vol.58: pp.60-65. 1958. Note on small collections of Lepidoptera from the Comoro Archipelago and Aldabra Is. Describes as new *Epipagis prolalis* (Aldabra) (Pyraustidæ). [P. V.]

Viette, P., "Nouveaux microlépidoptères de Madagascar" [in French]. *Bull. Soc. zool. France,* vol.83: pp.48-59, 9 figs. 1958. Description of new species of Œcophoridæ and Ethmiidæ from Madagascar: (Œcophoridæ) *Pseudepiphractis zelosarella* (Nosivola); *Rhozale ampolomitella* (Ambatalampy), *R. tricolorella saalmüllerella* (Sakaraha), *E. atriflorella* (Sakaraha), *E. oberthürella* (Sakaraha). [P. V.]

Viette, P., "Thyridides malgaches nouveaux ou peu connus (lépidoptères)" [in French]. *Bull. mens. Soc. linn. Lyon,* vol.27: pp.206-208. 1958. New or little-known species of Thyrididæ from Madagascar. Describes as new *Chrysotypus lakato* (E. Madagascar, Lakato); *Rhodoneura strix* (E. Madagascar, Italaviana), *R. subopalina orientalis* (E. Madagascar, Anosibe); *Proterozeuxis seta* (Lakato). [P. V.]

Viette, P., "Contribution à l'étude des Hepialidæ (33e note). *Korscheltellus fusconebulosus* (Degeer)" [in French]. *Entomologiste,* vol.14: pp.96-101. "1958" [1959]. Study of the subspecies of this hepialid; describes as new *K. f. shetlandicus* (Shetland Is.), *K. f. pyreneensis* (Pyrenees Mts), *K. f. centralis* (mountains of central France), *K. f. vosgesiacus* (Vosges Mts.). [P. V.]

Viette, P., "Lépidoptères de l'île Amsterdam (récoltés de Patrice Paulian, 1955-1956)" [in French]. *Bull. Soc. ent. France,* vol.64: pp.22-29, 6 figs. 1959. Note on a collection of Lepidoptera from Amsterdam Is. in the southern Indian Ocean.

Describes as new *Crambus reductus; Nomophila incognita; BRACHYPTERAGROTIS,* & type *B. patricei,* (Noctuinæ; brachypterous in both sexes); *Heliothis pauliani.* [P. V.]

Viette, P., "Descriptions préliminaires de nouvelles espèces de noctuelles de Madagascar et des Comores, III (Lep. Noctuidæ)" [in French]. *Bull. Soc. ent. France,* vol.64: pp.222-231. "1959" [1960]. Preliminary descriptions of new species of noctuids from Madagascar and Comoro islands: *Mentaxya comorana* (Anjouan); *Xylomania betsileo* (Betsileoland), *X. boby* (Andringitra Mts.), *X. hecate* (Marojejy Mts.); *Neostichtis inopinatus* (Integral Natural Reserve no.3); *MADEUPLEXIA* (Amphipyrinæ) & type *M. pretiosa* (Batsileoland), *M. altitudinis* (Andringitra Mts.), *M. sogai* (Ambatondrazaka) (*Euplexia retorta* Berio, 1956, belongs to this genus); *Altimæa monticola* (Andringitra Mts.); *Perigea duchesnei* (Analamerana forest); *Sciomesa janthina* (Andringitra Mts.); *Paracaroides behara* (Behara), *P. befasy* (Befasy forest); *Cyclopera gallienii* (Befasy forest). [P. V.]

Viette, P., "Deux nouvelles pyrales d'Indochine" [in French]. *Lambillionea,* vol.59: pp.87-89, 2 figs. "1959" [1960]. Describes as new *Stemmatophora chapalis* (Cha pa, Tonkin); *Doddiana tonkinalis* (Cha pa). [P. B.]

Viette, P., "Note sur différents taxa du genre *Morpho* Fabricius (Lep. Nymphalidæ Morphinæ)" [in French]. *Lambillionea,* vol.60: pp.11-14. 1960. List of types in Paris Museum, with localities. [P. B.]

Viette, P., "Pyrales de Madagascar et des Comores nouvelles ou peu connus (Lepidoptera)" [in French]. *Rev. franç. Ent.,* vol.27: pp.200-214, 13 figs. 1960. Describes as new *Crambus ankasokellus* (Ankasoka); *Syllepta stumpffalis* (Nossibe); *Coptobasoides marionalis* (Analamerana forest), *C. comoralis* (Grande Comoro); *Diaphana andringitralis* (Andringitra Mts.); *Ambia andasalis* (Marojejy Mts.); *Sindris minutalis* (Ampijoroa), *S. sganzini comorensis* (Grande Comore); *Doddiana analamalis* (Perinet); *Philotis gigantalis* (E. Madagascar). [P. V.]

Viette, P., "Thyridides et thaumétopoéides nouveaux ou peu connus de Madagascar (lépidoptères)" [in French]. *Bull. mens. Soc. linn. Lyon,* vol.29: pp.68-72. 1960. Describes as new: (Thyrididæ) *Chrysotypus phœbus* (Marojejy Mts.), *C. maculatus* (Lakato road); *Rhodoneura marojejy* (Marojejy Mts.); (Thaumetopœidæ) *PSEUDOHYSOIDES,* & type *P. bicolor* (Lambomakandro forest), *P. unicolor* (Analamerana forest), *P. vadoni* (Maroantsetra). [P. V.]

Viette, P., "Notes on some synonymous or preoccupied names in the Lepidoptera." *Entomologist,* vol.94: pp.38-39. 1961. Proposes *WISEANA* to replace *Philpottia* Viette, preoccupied (Hepialidæ); *FLETCHERODES* to replace *Pseudolimacodes* Viette, preoccupied (Limacodidæ). New synonymy in Notodontidæ (*Billetia*) & Noctuidæ (*Thalatha, Maliattha, Calosia, Bamra, Hypsiforme*). [P. B.]

Warnecke, Georg, "Was ist *Dyscia* (*Scodiona*) *emucidaria* Hübner 425 *nec* Duponchel?" [in German]. *Opusc. zool.,* no.34: pp.3-5, 1 fig. 1959. Synonym of *penulataria; emucidaria* Duponchel is *fagaria* or a nearly related sp. [P. B.]

Warnecke, Georg, "Studien zur Fauna der Grossschmetterlinge des Harz-Gebirges" [in German]. *Beitr. Naturkunde Niedersächsens,* vol.13: pp.21-31, 4 figs., 1 map. 1960. Describes as new *Gnophos sordarius hercynicus* (Bruchberg Moor, Oberharz). Discusses Harz Mts., N. Germany, and their boreoalpine Macrolepidoptera (*G. sordarius, Erebia epiphron, Anomogyna speciosa, Sterrhopteryx standfussi*), including general distribution, local forms, & biology. Notes some erroneous records. [P. B.]

Warren, B. C. S., "On *Erebia aquitania* Fruhstorfer: with a note on the value of anatomical characters in this and related species." *Ent. Rec.,* vol.71: pp.184-190, 1 pl. 1959. Redefines this species; describes & figures ♂ genitalia, showing variation. Also figures ♂ & ♀ genitalia of other spp. of the *E. tyndarus* group; discusses specific relationships and species characters, and gives a checklist and synonymy for this difficult group. [P. B.]

Watson, Allan, "A revision of the genus *Auzata* Walker (Lepidoptera, Drepanidæ)." *Bonner zool. Beitr.,* vol.9: pp.232-256, 1 pl., 47 figs. 1958. Describes as new *A. chinensis prolixa* (Chekiang, W. Tien-Mu-Shan, 1600 m.), *A. c. arcuata* (S. Shansi,

Tapaishan in Tsingling, 3000 m.), *A. superba cristata* (Shansi, Mien-Shan), *A. minuta spiculata* (Chekiang, E. Tien-Mu-Shan). Transfers *A. micronoides* to *Leucodrepana,* sinking *Auzatella* to *Leucodrepana;* transfers *Gonocilix renifera* to *Leucoblepsis.* Redescribes all forms; key to spp. & sspp. [P. B.]

Whalley, Paul E. S., "*Sematosopha leucodelta* Meyrick 1937—a synonym of *Piletocera albicinctata* Hampson 1887 (Lep.—Pyralidæ)." *Entomologist,* vol.91: p.270. 1959.

Whalley, Paul E. S., "The British species of the genus *Chrysocrambus* Blesz. (*Crambus* auctt.). Lepid. Pyralidæ." *Entomologist,* vol.92: pp.179-184, 1 pl., 4 figs. 1959. Figures adults of *C. craterellus, C. cassentiniellus, C. dentuellus,* & *C. cornutellus,* & genitalia of last 2 spp. (not certainly recorded from Britain). Discusses nomenclature. [P. B.]

Whalley, Paul E. S., "The British Pyralidæ and Pterophoridæ in the Bowes collection including a new species of plume moth (Lep., Pterophoridæ)." *Ent. Gazette,* vol.11: pp.27-30, 4 figs. 1960. Describes as new *Oidæmatophorus bowesi* (Ashford, Kent). Selects lectotype of *O. cinerariæ,* in Paris Museum. British records of some 60 spp. [P. B.]

Whalley, Paul E. S., "The genus *Ephestia* Guenée (Lep., Phycitinæ)." *Ent. Gazette,* vol.11: pp.183-184. 1960. Transfers British spp., except *E. elutella* & *Anagasta kühniella,* to *Cadra* Walker (=*Xenephestia* Gozmány). [P. B.]

White, M. J. D., "Cytogenetics and systematic entomology." *Annual Rev. Ent.,* vol.2: pp.71-90. 1957. Review includes applications of cytogenetics to classification on specific and higher levels; some discussion of panorpoid complex and of species differences in Lepidoptera. [P. B.]

Wiltshire, E. P., "New species and forms of Lepidoptera from Afghanistan and Iraq." *Journ. Bombay nat. Hist. Soc.,* vol.55: pp.228-237, 1 pl., 3 figs. 1958. Describes as new: (Lasiocampidæ) *Dendrolimus klapperichi* (Bashgul Valley, 1100 m., Nuristan, Afghanistan); (Lymantriidæ) *Euproctis froitzheimi* (Paghman Mts., 3000 m., E. Afghanistan); (Notodontidæ) *Damata dicyma* (Bashgul Valley, 1100 m.); *Harpyia pulcherrima nuristana* (Bashgul Valley); (Noctuidæ) *Lithophasia cyaxares* (Haj Omran, 1525-1830 m., Erbil prov., Kurdistan, Iraq); *Agrochola egorovi laciniatæ* (Haj Omran, 1830 m.; foodplant *Eremostachys laciniata*); *Archanara pringlei* (Amarah marshes, Iraq); (Syntomidæ) *Syntomis higginsi* (Salah-ud-din, 1037 m., Kurdistan). Also names a "form" of *Harpyia lanigera.* Lists 15 spp. added to Iraq list since his *Lepidoptera of Iraq.* [P. B.]

Wolff, Niels L., "Further notes on the *Stomopteryx* group (Lepid. Gelechiidæ)." *Ent. Meddelelser,* vol.28: pp.224-281, 2 pls., 62 figs. 1958. Describes as new *S. wormiella* (Amager, Denmark), *S. suecicella* (Bonarpshed, Sweden); *Iwaruna klimeschi* (Leopoldsberg, Vienna, Austria). Discusses this group of genera and the application of generic names; prefers to keep most spp. in *Stomopteryx* for the moment. Describes ♂ genitalia of group in general; discusses 19 other spp. in *Stomopteryx, Iwaruna, Monochroa,* & *Lamprotes,* with descriptive notes, discussion of identity, and figures of ♂ genitalia, adults, & venation. [P. B.]

Wolff, Niels L., "Notes on some species of the genus *Scoparia* Hw. (s.str.) (Lep., Pyraustidæ)." *Ent. Maddelelser,* vol.29: pp.179-192, 2 pls., 30 figs. 1959. Describes as new *S. sylvestralis* (Jungshoved, Zealand, Denmark). Describes ♂ & ♀ genitalia of *S. basistrigalis, S. ambigualis, S. ingratella, S. dubialis,* & *S. dubitalis.* Selects lectotype of *S. ambigualis.* [P. B.]

Wolfsberger, Josef, "Eine neue Unterart von *Gnophos intermedia* Wehrli aus der Steiermark (Lep. Geometr.)" [in German]. *Zeitschr. wiener ent. Ges.,* vol.44: pp.39-41, 1 pl. 1959. Describes as new *G. i. gulsensis* (Gulsenberg, Murtal, 600-900 m.). Notes on rearing, on dandelion. [P. B.]

Wyatt, Colin W., "Eine neue Rasse von *Papilio machaon* L. von Mt. Everest-Gebiet" [in German]. *Zeitschr. wiener ent. Ges.,* vol.44: pp.97-99, 1 pl. 1959. Describes as new *P. m. rinpoche* (Thyangboché Monastery, Solu Khumbu, Nepal, 3850 m.). [P. B.]

Wyatt, Colin W., "Eine neue Rasse von *Parnassius simo* Gray" [in German]. *Zeitschr. wiener ent. Ges.*, vol.45: pp.18-19, 1 pl. 1960. Describes as new *P. s. chenrezi* (Ludarwas Ganj, N. of Sonamarg, NE Kashmir, 4300 m.). [P. B.]

Yamamoto, Yoshimaru, "How to identify sphingid larvæ (1) – (4)" [in Japanese]. *Shin Konchu*, vol.2, no.1: pp.39-41, 2 figs.; no.2: pp.21-23, 5 figs.; no.3: pp.16-18, 4 figs.; no.4: pp.18-20, 4 figs. 1949. 15 spp. keyed. [T. I.]

Yamamoto, Yoshimaru, "Morphological studies on some sphingid larvæ in Japan (1)" [in Japanese]. *Insect Ecology*, vol.4, no.10: pp.13-22, 1 pl. 1952. Genera and species are keyed. [T. I.]

Ziegler, J. Benjamin, "Preliminary contribution to a redefinition of the genera of North American hairstreaks (Lycænidæ) north of Mexico." *Journ. Lepid. Soc.*, vol.14: pp.19-23. 1960.

F. BIOLOGY AND IMMATURE STAGES

Kubota, Hideko, *et al.*, "Some observations on *Pieris rapæ* in the farm" [in Japanese]. *Shin Konchu*, vol.6, no.2: pp.12-14, 6 tables. 1953. Laying site for eggs, sitting position of larvæ, pupation site, & flying activities observed. [T. I.]

Kudo, Shigemi, "Larvæ & pupæ of 4 *Argynnis* (Nymphalidæ)" [in Japanese]. *Insect Ecology*, vol.2: pp.22-27, 1 pl., 1 fig. 1948. Keys to the early stages of *A. paphia, sagana, laodice*, & *adippe*. Foodplants: *Viola* spp. [T. I.]

Kudo, Shigemi, "Photographic comments on the life history of butterflies (1) – (3)" [in Japanese]. *Collecting & Breeding*, vol. 13: pp.19-20, 151-155; vol.14: pp.204-208. 1951, 1952. Numerous photos of *Papilio machaon, Argynnis paphia paphioides, A. sagana, A. laodice japonica, A. ruslana, A. cydippe pallescens, Hestina japonica, Apatura ilia substituta* & *Sasakia charonda*. [T. I.]

Kudo, Shigemi, "Identification of *Papilio* larvæ" [in Japanese]. *Shin Konchu*, vol.5, no.9: pp.18-19, 1 pl. 1952. *P. bianor, maackii, xuthus, protenor, memnon, helenus*, & *machaon*. [T. I.]

Kühlhorn, Friedrich, jr., "Beitrag zur Kenntnis der Cecidien des Mansfelder Seckreises und des Stadtkreises Eisleben (Östliches Harzvorland)" [in German]. *Deutsche ent. Zeitschr.*, N. F., vol.4: pp.35-46, 12 figs. 1957. Records galls produced by *Orneodes dodecadactyla* on *Lonicera xylosteum*. [P. B.]

Kurian, Chandy, "Descriptions of five new and records and redescriptions of two known Bethyloidea (parasitic Hymenoptera) from India." *Agra Univ. Journ. Res., Sci.*, vol.3: pp.417-439, 45 figs. 1954. Includes two parasites of *Argyria sticticraspis*.

Kurian, Chandy, "Descriptions of some new chalcids (parasitic Hymenoptera) from India." *Agra Univ. Journ. Res., Sci.*, vol.3: pp.119-134, 36 figs. 1954. Includes 4 spp. reared from larvæ of *Natada neraria*, and one from eggs of *Schœnobius*. [P. B.]

Kurian, Chandy, "Bethyloidea (Hymenoptera) from India." *Agra Univ. Journ. Res., Sci.*, vol.4: pp.67-155, 255 figs. 1955. Includes numerous parasites of Lepidoptera, especially of Pyralididæ and Noctuidæ. [P. B.]

Kurir, Anton, "Die Frasspflanzen des Schwammspinners (*Lymantria dispar* L.) (Beitrag sur Ernährungsbiologie des Schwammspinners)" [in German]. *Zeitschr. angew. Ent.*. vol.34: pp.543-586, 4 figs. 1953. Feeding experiments with *L. dispar* larvæ on numerous plant spp., belonging to some 45 families of gymnosperms and angiosperms; the amount of feeding and success of rearing is indicated for each plant, and results of chemical analysis of leaves of many plants are summarized. Author concludes that leaves with high content of certain chemicals (including lactic acid, glycosides, saponins, tannins, alkaloids, etc.) are thereby protected against this species. Notes on relation between foodplant and color of frass. Extensive bibliography on foodplants of *L. dispar*. Larvæ fed actively on leaves of over 180 spp. of plants. [P. B.]

Kurir, Anton, "Einige Untersuchungsergebnisse aus der Gradation des Fichtennestwicklers (*Epiblema tedella* Cl.) in Österreich 1948-1950" [in German]. *Zentralbl. ges. Forst–und Holzwirtschaft*, vol.72: pp.121-147, 20 figs., 1 map. 1954. Describes all stages, biology, & location of outbreaks in Austria. [P. B.]

Kuznetzov, V. I., "Biology and systematic status of *Euzophera* species (Lepidoptera, Pyralidæ) injurious to pomegranates, apples and quinces" [in Russian; English summary]. *Rev. Ent. URSS*, vol.36: pp.59-71, 3 figs. 1957. *E. punicaella* in Central Asia and Caucasus. [N. O.]

Kuzuya, Takeshi, "Breeding record of *Ypthima motschulskyi* Bremer et Grey (Satyridæ)" [in Japanese]. *Insect Ecology*, vol.3: pp.83-86, 4 figs. 1951. Foodplant: *Digitaria ciliaris*. [T. I.]

Kuzuya, Takeshi, & Akira Takahashi, "On the life-history of *Cœnonympha œdippus annulifer* Butler (Satyridæ)" [in Japanese; English summary]. *New Entomologist*, vol.2, no.3/4: pp.43-50, 13 figs. 1952. Foodplants: various grasses and sedges. [T. I.]

de Laever, E., "Noctuelles et scorpions" [in French]. *Lambillionea*, vol.53: pp.79-80. 1953. Reports 1st instar scorpions (*i.e.* pseudoscorpions?) being carried in thick vestiture of early spring noctuids. [P. B.]

Laidlaw, W. B. R., "A preliminary enquiry into the influence of solar radiation on insect environment. With special reference to the relation between pest epidemics and fluctuation in solar radiation." *Trans. Soc. Brit. Ent.*, vol.11: pp.17-80, 6 figs. 1951. Reviews direct & indirect effects of radiation on living organisms. Believes that prime cause of epidemics is coincidence of radiation optimum for species, at a particular stage of sunspot cycle, with favorable climatic conditions and abundant food. No proof of a causal connection of sunspots with epidemics is given. On the basis of this theory a biological classification of pest spp. is outlined and numerous lines of research are suggested. [P. B.]

Lane, Charles, "Swallows and House Martins taking moths near an M. V. trap." *Entomologist*, vol.90: p.297. 1957.

Lane, Charles, & Miriam Rothschild, "Preliminary notes on insects eaten and rejected by a tame Shama (*Kittacincla malabarica* Gm.), with the suggestion that in certain species of butterflies and moths females are less palatable than males." *Ent. mo. Mag.*, vol.93: pp.172-179. 1957.

Langenbuch, R., "Beitrag zur Differentialdiagnose von Viruseinschlusskörpern (Polyedern) in Schnittpräparaten" [in German; English summary]. *Zeitschr. Pflanzenkrankh.*, vol.64: pp.443-444, 3 figs. 1957. Figures polyhedral bodies in larvæ of *Cacœcia murinana*. [P. B.]

Langston, Robert L., "A synopsis of hymenopterous parasites of *Malacosoma* in California (Lepidoptera, Lasiocampidæ)." *Univ. Calif. Publ. Ent.*, vol.14: pp.1-49. 1957. Records of parasites from 9 spp.; notes on adults, larvæ, & foodplants of hosts. [P.B.]

La Rivers, Ira, "Entomic nematode literature from 1926 to 1946, exclusive of medical and veterinary titles." *Wasmann Collector*, vol.7: pp.177-206. 1949. Collection of records of nematodes associated with various insects, including Lepidoptera (Sphingidæ, Noctuidæ, Eucosmidæ, Pyraustidæ). [P. B.]

Leatherdale, Donald, "The incidence of some gall-causing insects and mites in south Oxfordshire and central Berkshire in 1956." *Ent. mo. Mag.*, vol.93: pp.26-29. 1957. Includes records of *Mompha nodicolella* on *Chamænerion angustifolium*, *Heliozela staneela* on *Quercus petræa*, & *Nepticula argyropeza* on *Populus tremula*. [P. B.]

Le Charles, L., "La vie et les metamorphoses du *Charaxes jasius* Linné" [in French]. *Terre et la Vie*, vol.98: pp.21-31, 4 pls. 1951. Describes biology; good photos of all stages. [P. B.]

Lees, F. H., "An account of rearing *Heliophobus anceps* Schiff." *Ent. Rec. & Journ. Var.*, vol.66: pp.4-5. 1954. Reared on *Polygonum aviculare*. [P. B.]

Legosz-Owsianna, Danuta, "*Nothris verbascella* Hb. (Gelechiidæ) causing damages on mullein (*Verbascum phlomoides* L.)" [in Polish; English & Russian summaries]. *Bull. ent. Pologne*, vol.24: pp.201-208, 2 figs. 1956. Describes the life history and morphology of this sp. [J. M.]

Lejeune, R. R., & W. F. Black, "Populations of the Jack Pine Budworm." *Forestry Chron.*, vol.27: pp.14-22. 1951. Highest population levels of *Choristoneura pini* associated with abundance of ♂ flowers of host. [P. B.]

Lemarie, J., "Beitrag zur Kenntnis der Bionomie der Kiefernknowpentriebmotte *Exoteleia* (*Heringia*) *dodecella* L." [in Czech; German & Russian summaries]. *Folia zool.*, vol.6(20): pp.225-233, 11 figs. 1957. Discusses the life history of this harmful sp. Eggs, larvæ, & imagines are figured. [J. M.]

Lempke, B. J., "A note on rearing the larva of *Luceria virens* Linn." *Ent. Rec. & Journ. Var.*, vol.64: pp. 72-73. 1952. Thrive on neglect. [P. B.]

Lempke, B. J., "Further remarks on *Plusia festucæ* L." *Ent. Rec. & Journ. Var.*, vol.65: pp.245-246. 1953. Summary of published data on biology & phenology. [P. B.]

Lever, R. J. A. W., "A Malayan leaf-tying caterpillar from mangroves periodically submerged in sea-water." *Ent. mo. Mag.*, vol.88: p.95. 1952. *Argyroploce* sp.

Lindner, Erwin, "Ein Vorkommen von *Craspedothrix vivipara* B. B. (Dipt. Tach.). Ein Beitrag zur Parasitologie des Fichtenrindenwicklers *Laspeyresia pactolana* Zell (Lep. Tortric.))" [in German]. *Jahresheft Ver. Vaterländische Naturk. Württemberg*, vol.97/101: pp.115-124. 1949. Lists parasites & hyperparasites of this tortricid pest of spruce. [P. B.]

Linktree, P. H. D., "Courtship of *Lysandra coridon* and *L. bellargus*." *Entomologist*, vol.83: p.279. 1950. ♂ *L. coridon* courting ♀ of wrong sp. [P. B.]

Lipa, Jerzy Józefat, "Badania nad zmianami śmiertelności *Aporia cratægi* L. w kolejnych latach masowego pojawu (1952-1957) w Polsce" [in Polish; English summary]. *Zeitschr. Pflanzenkrankh.*, vol.64: pp.568-572. 1957. Notes on variation in mortality of early stages; percent of larvæ parasitized seems to vary with foodplant. [P. B.]

Lipscomb, C. G., & R. A. Jackson, "Some efforts to breed *Lysandra coridon* (Poda) var. *syngrapha*." *Entomologist*, vol.90: pp.55-57. 1957. Describes breeding procedure; moisture destructive to pupal stage. [P. B.]

Löhrl, H., "Füttert der Gimpel nur Sämereien?" [in German]. *Journ. für Ornithol.*, vol.98: pp.122-123. 1957. *Pyrrhula pyrrhula* reported feeding on larvæ of *Cacœcia murinana*. [P. B.]

Loeliger, R., "Ergebnisse der Zucht von *Saturnia pyri* im Sommer 1948" [in German]. *Ent. Nachrichtenbl.*, Burgdorf, vol.2: pp.81-93. 1949. Account of a cooperative project rearing this sp. [P. B.]

Lopez Cristobal, Ubaldo, "Dos nuevos himenopteros utiles" [in Spanish]. *Rev. Invest. agric.*, vol.1: pp.279-282, 2 figs. 1947. Describes 2 new ichneumonids; 1 reared from *Thyreion gelotopœon* & *Lycophotia margaritosa*, other from *Plusia ni*. [P. B.]

Ludwig, A., "Die Blattminen des Siegerlandes und der angrenzenden Gebiete" [in German]. *Abhandl. Landesmus. Naturkunde*, Münster, vol.15, no.2: 48 pp. 1953. Records over 400 mining insects. many of them Lepidoptera; listed by foodplant and also alphabetically. Records from Prevince of Westphalia, Germany. [P. B.]

Lübke, Anton, "Der Goldafter auf dem Nordsee-Inseln" [in German]. *Zeitschr. Pflanzenkrankh.*, vol.59: pp.221-223, 3 figs. 1952. *Euproctis chrysorrhœa* feeding on *Hippophaë rhamnoides*. [P. B.]

Lukefahr, M., & J. Griffin, "Mating and oviposition habits of the Pink Bollworm moth." *Journ. econ. Ent.*, vol.50: pp.487-490, figs. 1957. Detailed study of mating & oviposition habits of *Pectinophora gossypiella*. [W. C.]

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MODIFIED EDITORIAL ORGANIZATION

Since the adoption of the Society's Constitution in 1950 and its amendments of 1954 (see amended version in *Lepid. news* 9: pp.35-38; 1955) and 1959 (see *Lepid. news* 12: pp.157-158; 1959), the Society's publications have continued to develop, requiring further amendments. During the 16 years of the Society's existence, the publication program has always been, both formally and in practice, under the general direction of the same editorial chairman. This system has helped to give the publications and the Society some essential tradition and permanence during the early years. With this permanence now apparently assured, it is time to modify the official structure of the publication program so that there will be regular and moderately frequent changes of editorship of all the publications. We are most likely to induce the best possible editors to serve, if their term of labor is for a limited period of years. The following Constitutional amendments are proposed to establish these modifications.

In the past, the editor of the *Journal* (formerly the *Lepidopterists' News*) was designated "Editor-in-Chief" of the Society, and as new serials were established (the *News of the Lepidopterists' Society* and the *Memoirs*), the *Journal* editor had general supervision of them. Under the proposed new system, similar to that of many older biological societies, the Editorial Board would 1) determine broad publication policies of the Society and 2) recommend to the Executive Council the candidates for appointment to the editorships of the three Society publications. The three editors would select their own editorial committees. The Chairman of the Board might be one of the editors, but preferably not, to give him more freedom when new editors are being sought and to allow each editor to be essentially independent of the other two.

As provided by the Constitution (Article XII, Amendments), the following proposals for amendment have been signed by "not less than five members of the Society" (P. R. Ehrlich, J. F. Emmel, T. C. Emmel, S. A. Hessel, C. L. Remington, P. S. Remington, O. R. Taylor, T. L. Taylor) and submitted by the Secretary "to the Editor-in-Chief for publication in one of the Society's periodicals at least three months before the annual ballot is mailed in November".

Charles L. Remington

PROPOSED AMENDMENTS:

Art. II, Sec. 1: – for "a periodical" substitute "periodicals".

Art. IV, Sec. 2: – delete "the Editor-in-Chief".

Art. VIII, Sec. 1: – for "the number of numbers . . . and the Secretary" substitute "and shall be composed of four numbers".

Art. VIII, Sec. 2: – Insert between "meetings," and "and other matter": "summaries of the recent field collecting season".

Art. IX: – replace completely with the following:

Article IX. EDITORIAL BOARD

"*Section 1.* The publications of the Society shall be under the charge of an Editorial Board, consisting of a Chairman and two other at-large members, the Editor of the *Journal,* the Editor of the *News,* the Editor of the *Memoirs,* and the two Associate Editors of the *Journal.* The Chairman may also be one of the above five editors. It shall determine broad publication policies of the Society not otherwise provided for in the Constitution or the By-laws. It shall consider potential candidates for editorships and then make recommendations to the Executive Council for appointments of the three Editors."

"*Section 2.* The Chairman of the Editorial Board shall be appointed by the Executive Council for the term of three years, and he may be re-appointed. The Executive Council shall appoint, on recommendation of the Editorial Board, the three Editors, for terms of three years each; all three Editors may succeed themselves once.

"The Associate Editors and other members of the editorial committee of the *Journal* shall be appointed by the *Journal* Editor; their terms shall terminate with his term, but his successor may re-appoint any of them.

"Editorial committees or staff members of the *News* and the *Memoirs* shall be appointed by the respective Editors, but their terms shall terminate with those of their Editors; they may be re-appointed."

NOTICE TO CONTRIBUTORS TO THE *JOURNAL*

Contributions to the *Journal of the Lepidopterists' Society* may be on any aspect of the study and collection of Lepidoptera in any part of the world. Papers of more than twenty pages will not normally be accepted, but if they are, authors may be required to pay for overage.

ALL MANUSCRIPTS SHOULD BE DOUBLE SPACED (blank lines alternating with writen lines), and wide right and left margins are needed. Use only one side of the paper. The author should keep a carbon copy of the manuscript.

Legends of figures and tables should be written on separate sheets. Half-tones and tables must be kept within economical limits, and authors are normally charged for the cost of engraving and tables. Photographs should be glossy prints.

Titles must be kept as short as possible; Latin names of genera and species will be italicized, and authors of such Latin names WILL NOT APPEAR IN THE TITLE of any paper but may appear once in the text. The title should indicate the family of the subject. The style should conform to that used in recent issues of the *Journal*. PLEASE NOTE EXACT STYLE FOR REFERENCES. Footnotes should be kept at a minimum. The editors reserve the right to adjust style to fit standards of uniformity.

At least 50 gratis separates of papers of more than one page (25 of short notes) will be provided to authors if requested at the time galley proof is received for correction. Additional reprints and covers may be ordered at cost, at the same time.

Address correspondence relating to the *Journal* to: Dr. C. L. REMINGTON, Gibbs Research Labs., Yale University, New Haven, Conn., U. S. A.

Material not intended for permanent record, such as notices, should be sent to the *News* Editor: Dr. J. W. TILDEN, 125 Cedar Lane, San Jose, Calif., U. S. A.

Address remittances to: GEORGE EHLE, 314 Atkins Ave., Lancaster, Penna., U. S. A.

Address Society correspondence to: Dr. P. R. EHRLICH, Div. of Systematic Biology, Stanford University, Stanford, Calif., U. S. A.

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8 November 1963

THE LEPIDOPTERISTS' SOCIETY

1963 OFFICERS

The object of The Lepidopterists' Society, which was formed in May, 1947, and formally constituted in December, 1950, is "to promote the science of lepidopterology in all its branches, ... to issue a periodical and other publications on Lepidoptera; to facilitate the exchange of specimens and ideas by both the professional worker and the amateur in the field; to secure cooperation in all measures" directed toward these aims (*Constitution*, Art. II). A special goal is to encourage free interchange among the lepidopterists of all countries.

Membership in the Society is open to all persons interested in any aspect of lepidopterology. All members in good standing receive the *Journal* and the *News of the Lepidopterists' Society*. Institutions may subscribe to the *Journal* but may not become members. Prospective members should send to the Treasurer the full dues for the current year, together with their full name, address, and special lepidopterological interests. All other correspondence concerning membership and general Society business should be addressed to the Secretary. Remittance in dollars should be made payable to *The Lepidopterists' Society*. There are three paying classes of membership:

Active Members — annual dues \$6.00 (U. S. A.)

Sustaining Members — annual dues \$15.00 (U. S. A.)

Life Members — single sum \$75.00 (U. S. A.)

Dues may be paid in Europe to our official agent: E. W. Classey, 353 Hanworth Road, Hampton, Middx., England.

In alternate years a list of members of the Society is issued, with addresses and special interests. All members are expected to vote for officers when mail ballots are distributed by the Secretary annually. There are four numbers in each volume of the *Journal*, scheduled for February, May, August, November, and eight numbers of the *News* each year.

The Lepidopterists' Society is a non-profit, scientific organization. The office of publication is New Haven, Connecticut (see address inside back cover). Application for Second-class mail privileges has been approved at New Haven, Connecticut.

JOURNAL OF
THE LEPIDOPTERISTS' SOCIETY

Volume 17 | 1963 | Number 2

LABORATORY MASS-REARING OF *CISSEPS FULVICOLLIS* (CTENUCHIDAE), WITH NOTES ON FERTILITY, FECUNDITY, AND BIOLOGY

by JEANNE E. REMINGTON

I. INTRODUCTION

In the course of an investigation into the genetics of certain pupal and imaginal characters in *Cisseps fulvicollis* (Hübner) in 1956 and 1960-62, it was found that this diurnal moth is an excellent species for continuous mass-rearing in the laboratory. Its foods (various species of grasses) are widely obtainable in the outdoor growing season, or easily produced in the laboratory. It mates readily and oviposits freely in confinement. The duration of the life cycle is fairly short and there is no diapause under laboratory conditions, so successive generations can be reared continuously indoors, even through the winter. The adults are not vigorous flyers, which makes handling and feeding more convenient than for many Lepidoptera.

In the following sections, the techniques used for mass-rearing of *C. fulvicollis* are described, followed by observations on its biology, which were made as an adjunct to the genetic investigations. Also included are comments on comparable published findings reported for a few other Lepidoptera, to put the *Cisseps* observations in some perspective. No attempt was made to search the literature thoroughly, and the papers referred to are undoubtedly only a few of those which exist.

II. TECHNIQUE

This project was conducted in a windowless laboratory room, at a constant temperature of 22°C., under a bank of "daylight" fluorescent lights automatically set on a 24-hour cycle with 14 hours of light alternating with 10 hours of dark.

Females were isolated in circular clear plastic (polystyrene) containers about 8 cm. in diameter by 4.5 cm. deep. They were daily moved to fresh dishes when ova were laid, if a daily count of ova was desired; otherwise, they were left in the same container for the duration of oviposition. Every second day each adult was fed from a small disc of synthetic cellulose sponge saturated with a mixture of 1 part honey to 2 parts water. For feeding, each oviposition container was inverted over a Syracuse dish holding the sponge; the moths normally started feeding voluntarily within a few seconds, but during the first 24 to 48 hours they seemed disinterested in feeding. They were left on the sponge for about 10 minutes, or less if they had discontinued feeding.

The widespread techniques of feeding Lepidoptera adults in the laboratory from saturated wicks or small containers of sugar solution left in the cages have been tried at various times on many species in this laboratory. However, the fermentation of the solution which takes place rapidly in a warm room has been found to be detrimental to optimum egg production. Perhaps some substance such as calcium propionate could be added to retard this process. Another drawback to that type of feeding apparatus is that many adult Lepidoptera will not find the food source or will not learn to feed regularly from it. When our sponge method is used, they will inevitably come into contact with the sugar solution and will usually start feeding immediately; if not, the technician can unroll the proboscis with the aid of a dissection needle, and this often stimulates the insect to feed. Fermentation is eliminated because the solution is freshly mixed each day and is left out for only a short time, and the sponge and dish are thoroughly rinsed and dried between uses. The sugar solution should not reach the top of the sponge; it is enough to have it near the top so that the insect can reach into the holes in the sponge with its proboscis but will not get its legs sticky. The sponge method is especially important in crucial crosses where the maximum quantity of eggs if needed. With a few exceptions for groups with non-feeding adults, such as Saturniidae, feeding is essential if the breeder wishes to get maximum fecundity in confinement. In a tropical ctenuchid, *Ceramidia butleri*, HARRISON (1959) got only 56 eggs from 14 wild females, but the low number may be due to failure to feed the females.

The female firmly glued the eggs to the plastic container, often in linear strings of several eggs, and there was no need for grass to be present as an oviposition stimulator. When eggs had been laid in a container, a small piece of damp paper towel was put in to provide moisture and was redampened when dry. When the larvae were about to hatch, a few blades of fresh grass were put into the container to prevent the starvation and dessication which easily occur in the brief absence of food and moisture and are especially dangerous to newly hatched larvae.

The newly hatched larvae often, but not always, ate the eggshell immediately after hatching. SHOREY, *et al.* (1962) observed in laboratory rearing that undisturbed *Trichoplusia ni* larvae always did, although experiments showed no survival advantage during the first four days after hatching for those larvae which were allowed to do so compared to those removed from the hatching cage immediately after hatching.

All the 1956 larvae and the first generation of the 1960-62 broods were fed on outdoor lawn grass, which was dug up in circles of sod, put in clay flower pots, and brought into the laboratory. The second generation in 1960 was fed on laboratory-raised *Poa* sp. and *Festuca* sp. In 1961, *Poa pratensis* (Kentucky Blue Grass), *Lolium multiflorum* (Common Rye – narrow bladed) and *Lolium perenne* (Perennial Rye), all grown from seed, were tested and were all found to be unsuitable as food plants; the larvae commenced feeding but did not survive. The winter generations were reared successfully on *Festuca rubra* (Creeping Red Fescue) grown in the laboratory; this grass grows from seed to the usable height of about 2 inches in 7 days. *Stenotaphrum secundatum* (St. Augustine Grass) was an acceptable foodplant, grown from cuttings from Florida stocks; its wide blades and slowness to wilt when cut made it an ideal food, but it grew so slowly in the laboratory that it could not be used exclusively.

The grasses were grown in vermiculite in polyethylene boxes with holes drilled in the bottom. They were fed from below by a nutrient solution twice a day in an automatic hydroponics tank-table.

During the first two instars of the larval stage, it was most convenient to cut the grass and put small amounts of it in the larval rearing dishes. The bottom and sides of the dishes were lined with paper toweling; this could be changed easily when necessary, and it kept the containers relatively free of water droplets, which are dangerous to small hairy larvae. Four small holes were drilled in the top of each container to facilitate the movement of air. Before the tops were perforated, it was found that the larvae would become anaesthetized, apparently from accumulated carbon dioxide, with high mortality resulting.

A free-standing shelf of copper wire screening, consisting of a circle about ⅔ the diameter of the dish and supported by a strip of bent screen, was used in each larval rearing dish. Each day or two, when the dish was cleaned, the shelf was lifted out, with most of the larvae clinging to it. The paper at the bottom, containing the feces and old grass blades, was discarded and new paper put in. The side-lining paper could be returned to the dish with the larvae still clinging to it. Then the grass on the shelf, with some larvae on it, was put in the bottom and new grass placed on the shelf. The larvae usually climbed quickly up to

the new grass, and thus did not need to be handled individually when the dish was next cleaned. Handling leads to increased mortality, particularly of those larvae in a pre-molt phase.

To defer growth, or if foodplant temporarily runs short, larvae in the middle instars can be stored for several weeks in a cold chamber. A constant-temperature laboratory room, kept at 14-16°C., was used successfully, but the much lower temperature of a refrigerator at common household setting was fatal to the larvae. In the cold room they were kept in the regular rearing containers, partly filled with slightly damp (not wet) sphagnum moss in which they burrowed.

When the larvae were in the last instars they were transferred to gallon polystyrene jars with screen tops. Grass was supplied either by being grown in the container, or by putting two of the cubical polyethylene dishes containing growing grass in each gallon container. In the former case, if few enough larvae were put into it and the container left on the hydroponics table, the grass growth kept pace with larval consumption. In the latter case, the two cubical dishes had to be removed every two days and the larvae transferred to new dishes of grass.

There was very little evidence of disease in the course of these experiments. Ordinary clean laboratory procedures were used, but no sterilization of equipment was necessary.

Pupation cccurred in loose cocoons spun on the grass blades or on any surface within the container. In the case of the "cocoonless" individuals (those having a supposedly genetic tendency to pupate without spinning a cocoon), the pupae were lying free on the bottom. Pupae were put into small glass shell vials, closed with a loose wad of cotton, and permitted to hatch there.

The adults were confined in pairs in polystyrene containers under the "daylight fluorescent lights. If no ova were laid within a week, the first male was removed and a second male introduced. In some cases a male whose mate had produced fertile ova was paired with a second female.

The sexes are not difficult to distinguish in the adult moths when pairs are being selected for isolation. The best criteria are:

1) The pectinations of the male antennae are long (their length being about twice the width of the flagellum) and narrow and almost parallel-sided; the corresponding rami of the female antennae are much shorter (about the same length as the width of the flagellum) and rounded, somewhat oval or club-shaped.

2) In the male the frenulum consists of one stout spur, and in the female there are two, slenderer spurs; in both sexes these are long (about 0.3 the length of the hind wing, from which the frenulum arises near the base), slender, shiny, and copper-colored. The receptaculum for the

frenulum is on the under side of the forewing and is sexually very different, in the male being a single thumb-like hook arising from the anterior portion of the forewing in the male and in the female being a tuft of many stiff, hair-like bristles arising from the posterior portion of the forewing. These distinctions are easier to use than differences in the abdominal apex.

In the pupal stage, or on the empty pupal shell after the moth has emerged, the sexes can be distinguished by the position of the genital aperture. In the males, it is located on the 9th sternum, close to the anal aperture; in the females it is on the 8th sternum, about twice as far from the anal aperture as it is in the males.

III. Mating Behavior

In most of the cases in which copulation was observed, its duration was 2 to 5 hours. The original 1956 wild pair, which had been captured *in copulo,* remained together for several hours despite being gently transferred to a container and taken in an automobile to the laboratory. The longest observed mating was of a pair which had been inactive for three hours (7-10 A.M.) under distant fluorescent ceiling lights and some light at a very oblique angle from "daylight" fluorescent lights. They paired immediately at 10 A.M. when put under the direct light of a 150 watt desk lamp, and they remained paired for at least 12 hours, 20 minutes but had separated by 8:55 the following morning.

Both males and females of 12 observed pairs varied in age from 1 to 15 days at time of the first observed copulation. None were seen to mate before 24 hours after eclosion.

Some pairs were seen to copulate twice, the second time following the first by as little as an hour or as long as 8 days. One male mated with 3 females, when he was 6, 9 or 10, and 14 days old; the first of these was unsuccessful, with none of the 152 eggs laid showing signs of any development. One pair which had been confined together for 8 days and had already produced fertile eggs, was found in subsequent copulation which lasted at least 5 hours, 45 minutes (this was the female which had a late, second peak in number of eggs laid; see Table I). Another pair which had been together for ten days, with no eggs laid, was then observed *in copulo* for at least 3 hours, 13 minutes. Two pairs which had mated once with only one to two ova produced were subsequently found *in copulo,* but either none or only a few further eggs were laid. However, in other cases the females accepted the second pairing even though fertilized eggs had been laid right up to the day of re-pairing.

Mating always commenced in the forenoon, soon after the lights in the windowless control room went on. On one occasion, many pairs were

put in a light-proof dark chamber at 3:45 P.M. and then removed to bright light at 2:05 P.M. the following day. No pairings were made during 2½ hours of subsequent observation.

The pairs usually rested on the bottom surface of the container when *in copulo,* but if they were on the side of the container, they were vertically oriented, the male usually head downward.

DISCUSSION

Duration of copulation was not shown to have an effect on the success of fertilization. The longest duration (at least 12 hrs.) resulted in fertilization. The exact duration of the shortest was not observed, but among those with the least time, there were many fertilizations. This may be contrasted with results of 7 *Papilio xuthus* pairings in which the 3 of very short or very long duration produced no fertile eggs (Remington, 1960). It was observed in these *Papilio* matings that "long duration is usually caused by abnormal initial coupling, in which event insemination is not effected and disengagement is difficult". The long *Cisseps* mating noted here was disengaged without artificial help, although in some other cases both members of a pair remained together and died; if artificial separation was made, it resulted in such damage to the individuals that they lived only a short time and the females were unable to oviposit.

The duration of copulation has been found to vary with the temperature in *Pieris brassicae* (David & Gardiner, 1961). Temperatures of 20°, 25°, and 30°C. were used, and copulation lasted longer at the lower temperatures. In a different experiment, five pairs of *Trichoplusia ni* at 27°C. remained *in copulo* an average of 33 minutes, but the period varied from 19 to 44 minutes (Shorey, *et al.,* 1962).

Pieris brassicae females did not usually pair again for 5 or more days after the first mating, although males often mated several times in one day. Of 20 ♀♀, 2 mated twice the first day of the test (when they were 2-3 days old) and one of the 2 again on the second day. By the 10th day, 18 of the 20 had mated twice (one mated 3 times, 2 mated 4 times). In another group of *brassicae* 5 ♂♂ mated 1 to 4 times in 5 hours, and some of the 15 ♀♀ twice in the 5 hours (David & Gardiner, 1961).

94 ♀♀ of *Trichoplusia ni* confined continuously with a large number of males mated successfully a mean of 2.0 times (dissection showed 0 to 6 spermatophores) and the males more, since there were fewer males than females in the experimental cage.

The age of adults when ready to mate appears to be about the same in *Cisseps, Pieris,* and *Trichoplusia,* in the observations noted here. No

matings were observed before 24 hours of age in *Cisseps*. In *Trichoplusia ni* no matings were observed until the second night after emergence (this species is nocturnal). *Pieris brassicae* adults did not mate readily until a "day or two" after emergence, and it was unusual for either sex to mate when less than 18 hours old. *Pieris* adults stored at 12.5°C. and 60% humidity until 7-10 days old mated readily when put in 29° rooms, and all eggs were fertile. However, after storage of 19-20 days most ♂♂ died; the ♀♀ mated with 7-10 day old ♂♂ but fertility was lowered.

Although *Pieris brassicae* and *Cisseps fulvicollis* are both diurnal insects, *Cisseps* was found to commence mating (in the laboratory) soon after the light went on, whereas *Pieris* was said to favor no particular time of day for mating as long as the temperature and light conditions were satisfactory.

IV. Fecundity

The data on fecundity are based on 12 females, laboratory-reared siblings from one pair of wild parents.

Oviposition very rarely began within 24 hours after copulation, or as long as 72 hours after; most commonly it began between 36 and 48 hours after copulation. The females were from 2 to 16 days old when oviposition commenced; each had been confined with a male within a few hours after her eclosion from the pupal shell. There was a fairly even distribution of ages between the two extremes. One female (1-f) continued laying fertile eggs 15 days after her last contact with a male, and two other females for 8 and 9 days, respectively.

The greatest percentage of ova (22.8%) were laid by this group on the 5th and 6th day after oviposition began, the number thereafter declining steadily, as shown in Table I and Figure 1. However, two females (1-e and 1-f) laid their greatest number the 1st and 2nd day of oviposition, ♀ 1-g and ♀ 1-l laid their largest number the 3rd and 4th days, ♀ 1-j had a peak on the 7th and 8th days, and ♀ 1-d on the 9th and 10th days. For the last-named ♀, copulation had been observed on the day before and this was at least the second of her pairings, for she had already laid fertile ova; after this peak she went on ovipositing for 10 more days before her death.

There was also great variation in total number of eggs laid. Each of the 12 females laid a total of from 104 to 299 ova in an ovipositing period of 8 to 20 days.

Discussion

The findings with *Cisseps* that the greatest percentage of eggs were laid on the 5th and 6th days of oviposition differs from those with a

Table I. DISTRIBUTION OF EGG-LAYING OF 12 SIB-MATED, LABORATORY-REARED ♀♀ OF *C. FULVICOLLIS.*

Mother	Days after start of oviposition 1 & 2	3 & 4	5 & 6	7 & 8	9 & 10	11 & 12	13 & 14	15 & 16	17 & 18	19 & 20
♀ 1-a	67	8	82	24	8*	—	—	—	—	—
♀ 1-b†	2	4	53	18	10	26	22	17*	—	—
♀ 1-c	6	24	52	33	40	44	4	2*	—	—
♀ 1-d	41	0	29	37	95	21	11	11	16	6*
♀ 1-e	86	54	25	0*	—	—	—	—	—	—
♀ 1-f	43	14	0	0	0	17	26	4*	—	—
♀ 1-g	51	68	22	18	43	38	10	1*	—	—
♀ 1-h	24	53	62	0	48*	—	—	—	—	—
♀ 1-i	8	42	92	51	5	46	39	16	0*	—
♀ 1-j	38	11	15	74	40	36	15*	—	—	—
♀ 1-k	69	0	89	53*	—	—	—	—	—	—
♀ 1-l	16	43	39	47	32	22*	—	—	—	—
Total	451	321	560	355	321	250	127	51	16	6
%	18.3	13.1	22.8	14.4	13.1	10.2	5.2	2.1	.7	.2

† None of her eggs developed, although copulation had occurred.
* Found dead here, in routine alternate-day inspection.

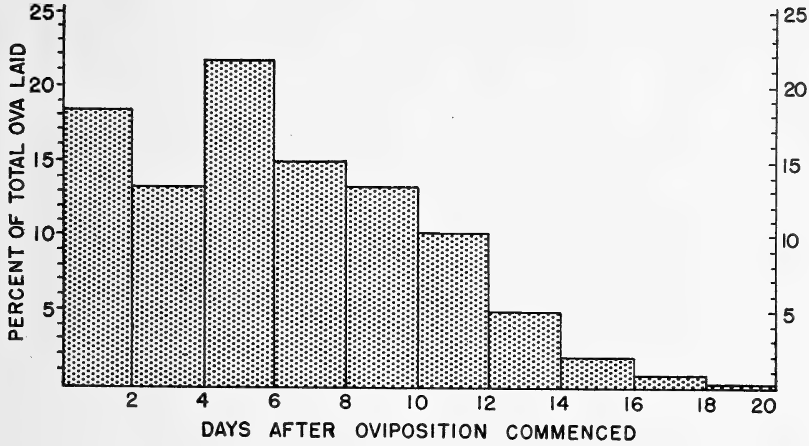

Fig. 1. Percentage of total ova laid by 12 ♀♀ in successive two-day periods (see Table I for individual performances).

phycitid moth, *Anagasta* (=*Ephestia auctt.*) *kühniella,* in that the latter laid the greatest number the first two days, then fewer each successive day (Norris, 1936). The *Cisseps* oviposition activity is similar to that of 99 females of *Trichoplusia ni* in which the most eggs (32%) were laid on the 5th and 6th days after commencement of oviposition (McEwen & Hervey, 1960). [Another group of *Trichoplusia* had low (23%) hatchability, indicating mating difficulties, and these data are not reviewed here.] The *Trichoplusia* females laid for only 12 days, while *Cisseps* laid for 20 days. David (1957) found that *Pieris brassicae* females start laying 2 to 3 days after eclosion and reach a maximum in 2 to 3 days more.

V. Fertility and Hatchability

Of 426 ova laid in the laboratory by 2 wild females (Table II), 99% showed the signs of fertilization (early stages of differentiation in the embryo). Among 1727 ova laid by 14 sibling-mated laboratory-reared females the percentage of ova showing signs of fertilization was almost as large: 97.1%. It may be observed from Table III that there was no decline in fertility with age; note the high hatchability (and therefore fertility) even late in the oviposition period, for 3 of the 4 females (the 4th had sharp fluctuations, which are not directly correlated with age).

Table II shows a great difference in hatchability of the eggs between that of the wild, presumably outcrossed, females (98.1%) and that of the inbred females (59%). But Table III again shows that there was

Table II. FERTILITY AND HATCHABILITY OF OVA.

A. Ova from Wild Females.

Egg layer	Number laid	Number hatched	Number unhatched: showed some development	Number unhatched: showed no development
♀21	233	232	1	–
♀22	193	186	3	4
Total	426	418 (98.1%)	4 (0.9%)	4 (0.9%)

B. Ova from Sib-mated Females.

Egg layer	Number laid	Number hatched	Number unhatched: showed some development	Number unhatched: showed no development
♀1-a	67	67	–	–
♀1-d	148	58	79	11
♀1-f	47	0	16	31
♀1-i	8	2	6	–
♀1-l	98	8	90	–
♀21-a	103	99	4	–
♀21-e	111	80	31	–
♀21-j	179	76	97	6
♀21-k	210	117	92	1
♀21-m	235	208	27	–
♀21-u	2	0	1	1
♀22-d	193	133	60	–
♀22-e	168	76	92	–
♀22-f	158	99	58	1
Total	1727	1023 (59.2%)	653 (37.9%)	51 (3.0%)

Table III. PERCENTAGE OF HATCH FROM OVA LAID ON SUCCESSIVE DAYS.

A. Wild Females.

Egg-layer	Date	No. laid	No. hatched	% hatched
♀ 21	Oct. 4-5	89	89	100.0
	Oct. 5-6	35	34	97.1
	Oct. 7-10	64	64	100.0
	Oct. 10-11	9	9	100.0
	Oct. 15-18	36	36	100.0
♀ 22	Oct. 4-5	34	30	88.2
	Oct. 5-6	40	40	100.0
	Oct. 6-7	13	13	100.0
	Oct. 7-10	106	103	97.2

B. Sib-mated Females Reared in Laboratory.

Egg-layer	Date	No. laid	No. hatched	% hatched
♀ 21-m	Nov. 17-18	87	80	92.0
	Nov. 19-20	29	28	96.6
	Nov. 20-22	43	36	83.7
	Nov. 22-23	15	10	66.7
	Nov. 23-27	51	48	94.1
	Nov. 28-30	11	6	54.6
♀ 1-d	Nov. 12-13	31	12	38.7
	Nov. 19-20	33	6	18.2
	Nov. 21	62	38	61.3
	Nov. 22-27	43	11	25.6
	Nov. 29	20	2	10.0

no clear decline of hatchability due to the age of the mother or to the number of eggs she had laid; high percentages of hatch were maintained throughout the period of the 2 wild females and fairly high even in the middle and late stages for the 2 inbred females, although the hatch for the latter was lower and more uneven.

DISCUSSION

The high fertility of *Cisseps* eggs (97-99%) is paralleled in the fertility of eggs of wild *Colias philodice* and *eurytheme* (Ae, 1958); of 762 eggs laid by 16 females, 99% were fertile. AE also found (1961) that of 288 eggs laid by 3 wild females of *Papilio protenor* 99.3% were fertile; 98.2% of them hatched. The low (11.8%) fertility and hatchability of the 76 eggs of one wild *Papilio helenus* female was attributed to a shortage of spermatozoa, since the female was old when collected.

The eggs of *Trichoplusia ni* were found to be 80% hatchable in the laboratory at 14°C., and to decrease in hatchability to 70% at 32° (Shorey, *et al.*, 1962). In a different investigation on the same insect (McEwen & Hervey, 1960) 3 colonies at the same temperature (23-25°C.) varied widely in hatchability:

1st colony – 61 ♀♀ (15,793 eggs laid) – 40.1% hatched
2nd colony – 34 ♀♀ (6,731 eggs laid) – 23.0% hatched
3rd colony – 38 ♀♀ (13,337 eggs laid) – 73.4% hatched

The reasons for the variation could not be determined, but "eggs which failed to hatch showed no evidence of embryonic development and collapsed 2-3 days after deposition". This may have been due to non-fertilization.

NORRIS (1936) found that the proportion of eggs of *Anagasta kühniella* hatching from one sibling pair in each of 12 generations varied from 63 to 93%.

REMINGTON (1959) observed that it is "usual for *Papilio* females to have decreasing fertility in the course of egg-laying, regardless of the father."

VI. DURATION OF STAGES

The duration of the egg stage appeared to be 5 to 6 days. Twenty-one eggs (from ♀ 21-m) which were laid during a 10 minute period on 18 November were segregated and external changes during development at the controlled temperature were recorded as follows. This female had started ovipositing the day before and continued for 12 days thereafter; all eggs were fertile.

Age in hours	*Development*
24	Opaque white, no differentiation
48	No change
71	A faint transparency developing around lower edge
95	A cluster of minute brown spots at top; definite differentiation between zones of paler and deeper yellow
120	Larvae appear fully developed, visible through transparent shell
124	No change
125	First 2 larvae hatched
125.5	1 more larva hatched
126	3 more larvae hatched
126.75	4 more larvae hatched
127	6 more larvae hatched
128	1 more larva hatched
129	2 more larvae hatched
130½–140	Last 2 hatched during this period

Another group of timed eggs hatched later than 122 hours and before 144 hours. Out of a third group (38 eggs), 30 larvae hatched in about 120 hours, 1 between 120 and 144 hours, and 7 between 144 and 168 hours.

In a group of 9 timed larvae, there were 4 instars (varying in total duration from 17-21 days) before successful pupation for 7 of the individuals (5♂♂, 2♀♀). The 2 others had 6 instars and then died.

The pupal stage normally lasted 7-11 days. There was a sexual difference in developmental time. Of 22 larvae whose pupal stage began synchronously and which were reared together, eclosion was as follows:

	♂♂	♀♀
1st day	7	3
2nd day	4	2
3rd day	0	3
4th day	1	1
5th day	0	1

Thus, 11 of the 12 ♂♂ had emerged in the first two days and only 5 of the 10 ♀♀.

There was also a sexual difference in the length of the imaginal stage. For 12 females this stage varied from 12-30 days, with half of them living 22-30 days. For 8 males the duration varied from 3-23 days, with half of them living 18-22 days.

In summary, at the constant temperature of 22° C. and a 14-hour photoperiod, the normal life cycle in days was as follows: egg 5-6, larva 17-21, pupa 7-11. The minimum observed development from egg to adult was 29 days; the maximum (abnormal) 62 days.

In outdoor conditions *C. fulvicollis* is multivoltine and probably hibernates in the larval stage (Dyar, 1901). There was no diapause under laboratory conditions. As many as 5 successive generations were reared through the winter, and this could have continued indefinitely.

DISCUSSION

DYAR (1901) reported that some *C. fulvicollis* from New York City which he reared hatched from eggs about Sept. 15 and became imagos on Oct. 19 (a total of 39 days if the eggs took 5 days to hatch). COMSTOCK (1937) recorded a pupal duration averaging 6 days for individuals of *C. fulvicollis* collected in the Sierras of California. None of the pupae in the present experiments took as few as 6 days, although a few required only 7 days. Perhaps there is a genetic difference in developmental period between these and California populations, but COMSTOCK's pupae may have been kept at a higher temperature. Developmental time is under genetic, as well as environmental, control, and it can be presumed that in some regions natural selection favors genes for faster developmental rate than in other regions (see, *e.g.*, Dawson & Lerner, 1962).

The large observed variability of total developmental time in the present experiments has also been reported for other Lepidoptera. *Anagasta kühniella* varied from 88-137 days at "room temperature" over 12 generations (Norris, 1936). ATWAL (1955) reported that temperature, photoperiod, and quality and age of foodplant influenced the length of life cycle of *Plutella maculipennis* Curtis. While temperature and photoperiod in the *Cisseps fulvicollis* experiments were uniform, the varying quality and age of the grass brought in from outdoors may have influenced those broods whose life cycle was studied. LONG (1953) found that crowding of lepidopterous larvae increased the rate of development and the simultaneity of pupation, and decreased the number of instars. In the *Cisseps* experiment, the individuals which were closely observed during the larval and pupal stages were kept in solitary or uncrowded conditions, so that factor was negligible. *Trichoplusia ni* larvae had from 5 to 7 instars depending on conditions (Shorey, *et al.*, 1962).

The sexual difference in developmental time has also been observed in other Lepidoptera, such as *Plutella maculipennis* in which females developed more slowly than males, irrespective of temperature and food (Atwal, 1955). There is a widespread presumption that this is generally true for Lepidoptera, although *Trichoplusia ni* in the experiments of SHOREY, ANDRES, and HALE showed no sexual difference in the length of the larval stage on four kinds of food and at four different temperatures. In the pupal stage the females developed 4-6% *faster* than males when the larvae had been reared on beans, but not on cabbage.

Table IV. SEX-RATIO OF REARED ADULTS.

Brood	♂♂	♀♀
1st generation, 1956	11	14
2nd generation, 1956	19	10
1st generation, 1960	94	91
2nd generation, 1960	1	2
1st generation, 1961	15	21
2nd generation, 1961	78	53
3rd generation, 1961	149	128
4th generation, 1961	88	83
5th generation, 1961	74	47
Totals	529	449

VII. Sex-ratio

The sex-ratio of 978 reared adults was found to be 1.00 : 0.85 (see Table IV). In the five 1961 broods 45 others were in too poor a condition for accurate sexing, or were missing in both pupal shell and adult at the time of the sex-count.

The sex-ratio of 323 reared adults of *Trichoplusia ni* was 1:00 : 1.17, a predominance of females (Shorey, *et al.*, 1962).

Summary

1. The techniques used in the mass-rearing in the laboratory of successive generations of *Cisseps fulvicollis* are described.

2. Copulation was observed to continue for a period of 2 to 5 hours. Both males and females may copulate at least twice, the second pairing following the first by as little as an hour or as long as 8 days. Fertile ova may be laid before and/or after the second mating. Oviposition usually started within 48 hours after copulation and continued for 8 to 20 days totalling about 100-300 ova from each female. The greatest number of ova were laid on the 5th and 6th day after commencement. Females continued to lay fertile eggs 15 days or more after isolation from males.

3. 99% of the 426 ova from two wild females were fertile. 97.1% of the 1727 ova from sibling-mated laboratory-reared females were fertile.

Hatchability of the first group was 98.1%; of the second, 59.3%. Fertility and hatchability of ova laid on different days by any one female did not show a decline with age or number of eggs laid by the mother.

4. The egg stage usually lasted 5-6 days; siblings hatching from eggs laid almost simultaneously had different rates of embryonic development. Larval duration was usually 17-21 days, pupal duration 7-11 days. Total cycle from new egg to adult eclosion varied from 29 to (rarely) 62 days, at 22° C. and 14 hours photoperiod. Males developed faster than females. There was no diapause under laboratory conditions.

5. Of 978 reared adults, 529 were males and 449 females, a sex-ratio of 1.00 : 0.85.

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TWO NEW SPECIES AND ONE NEW SUBSPECIES OF MEGATHYMIDAE FROM MEXICO AND TEXAS

by Don B. Stallings, J. R. Turner, Viola N. Stallings

The two new species described in this paper were selected for description at this time from a number of new species that we are in the process of studying. Each is a representative of a group of species that are closely related. Subsequent papers will describe the other species, using this paper as a reference point. We are constantly amazed at how subtle speciation can be among the Megathymidae. Populations that at first glance appear to be the same, are, after considerable study, often found to be very distinct. The two species herein described are prime examples.

MEGATHYMUS GAYLEAE Stallings, Turner, & Stallings, NEW SPECIES

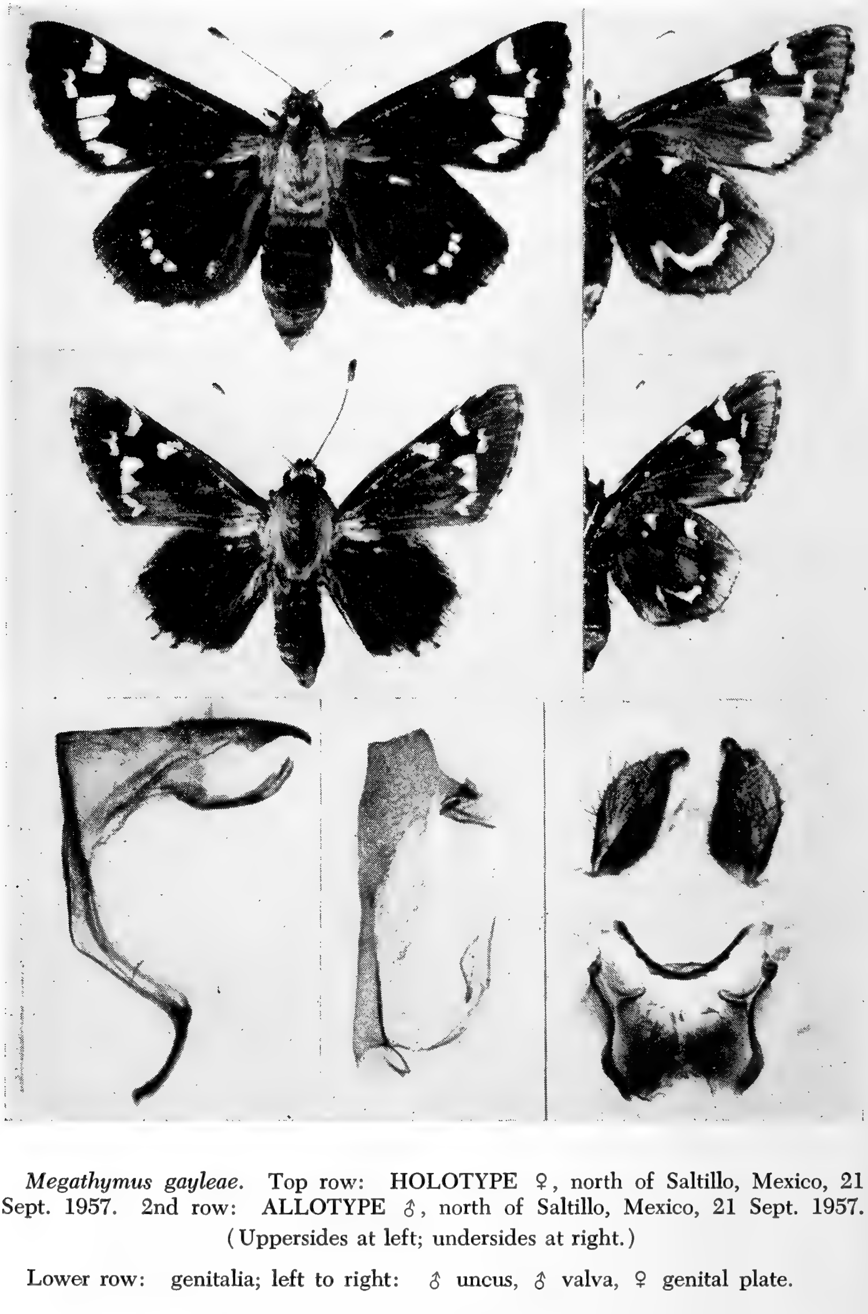
Female. Upper surface of primaries: black with very few olive-green and gray hairs intermingled at base; apex with a few scattered white scales; spot 1 (cell spot) roughly square, spots 2, 3, & 4 (subapical spots) rectangular and of even size and pretty much in alignment (outside line formed by these 3 spots if extended downward would pass through spot 6); spots 5 & 6 (submarginal spots) narrow, spot 5 cresent-shaped and 6 rectangular; spots 7, 8, & 9 (marginal band) with spot 7 roughly rectangular but with inward side not parallel to outward side, spot 8 smaller than 7 and rectangular and toothed inwardly, spot 9 smaller than 8 and appearing as a thick crescentic band, toothed inwardly; all 9 spots light chalky yellow in color; fringes checkered black and smoke.

Under surface of primaries: dull blackish with apex and some of outer margin very lightly overscaled with white; all the dorsal spots reappear but are much lighter, with spots 2, 3, 4, 5, & 6 white.

Upper surface of secondaries: black with very few olive-green and gray hairs intermingled at base; the light chalky yellow discal band composed of 4 small distinct spots, plus a faint spot near anal angle represented by a few scales; a few light chalky yellow scales along outer margin between veins M_1 and M_3; fringes very narrow, white in color, faintly checkered with black.

Under surface of secondaries: dull blackish, with area inside discal band overscaled with a few very short, light brown hairs and with area outside discal band more heavily overscaled with white; white discal band well defined and more narrow at ends than in center area; a triangular white spot in costal area close to base and a second white rectangular spot in costal area outward from first white spot; a third smaller white rectangular spot below second spot and slightly outside of it; center of wing has small area without brown hairs; costal area faintly overscaled with white hairs and scales; fringes very light brown.

Abdomen black above and brown-black below. Thorax olive-green above, brown-black below. Palpus white with some hairs capped in brown. Antenna with tip of club black, remainder of club and shaft white heavily overscaled with brown on upper side, but with more white below. Antenna of ♀ shorter than in ♂.



Megathymus gayleae. Top row: HOLOTYPE ♀, north of Saltillo, Mexico, 21 Sept. 1957. 2nd row: ALLOTYPE ♂, north of Saltillo, Mexico, 21 Sept. 1957. (Uppersides at left; undersides at right.)

Lower row: genitalia; left to right: ♂ uncus, ♂ valva, ♀ genital plate.

Length of forewing: 23.5 mm. to 32 mm., average 30 mm. Measurements of Holotype: forewing, apex to base 30mm., apex to outer angle 19 mm., outer angle to base 20 mm.; hindwing, base to end of vein Cu_1 20.5 mm.

Male. Upper surface of primaries: black with very few olive-green and gray hairs at base; tip of apex slightly overscaled with white; all 9 spots smaller than in ♀ and slightly paler in color, with spots 2 & 3 white; spots 7 & 8 toothed inwardly, with spot 7 the larger; spot 9 composed of two bars, forming a "V" with the base pointed inward; fringes checkered black and smoke.

Under surface of primaries: as in ♀, except the spots are smaller.

Upper surface of secondaries: black with very few olive-green and gray hairs at base; a band of light chalky yellow overscaling along outer margin; fringes very narrow, white, faintly checkered with black.

Under surface of secondaries: dull blackish with area inside discal band overscaled with a few very short, light brown hairs and area outside discal band more heavily overscaled with white; discal band composed of a black band with a white spot just below costal area and a long narrow "V" shaped white spot in anal area; a triangular white spot near base in costal area and a narrow black spot below this white spot; costal area overscaled with white; fringes on underside checkered light and dark brown.

Abdomen, palpus, and antenna as in ♀. Thorax differs from ♀ in being gray and black with very little olive-green above, otherwise like ♀.

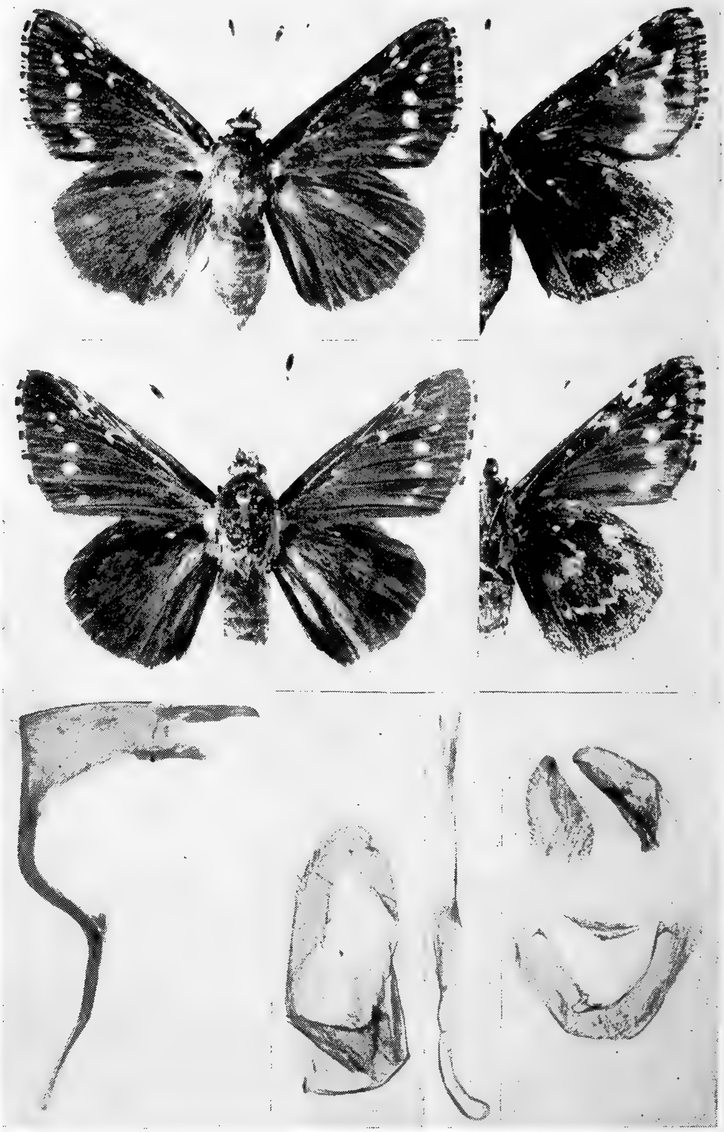
Length of forewing: 13 mm., to 27 mm., average 25 mm. Measurements of Allotype: forewing, apex to base 25 mm., apex to outer angle 16.5 mm., outer angle to base 16.5 mm.; hindwing, base to end of vein Cu_1 16 mm.

Described from 58 specimens (40 ♂♂ and 18 ♀♀) collected as larvae 23 kilometers morth of Saltillo, Coahuila, Mexico on Highway 57 (formerly Hwy. 75) at Km. marker 903 (old marker Km. 417) at an elevation of 4200 ft.; emerged in confinement from 16 Sept. to 7 Oct., 1957 and 1962. Collected by Dr. & Mrs. R. C. Turner, Dee, Jack, Viola and Don B. Stallings, and in 1962 H. A. Freeman.

HOLOTYPE: female, 21 Sept. 1957, and ALLOTYPE, male, 21 Sept. 1957, are in the collection of the authors. Paratypes will be placed in the collections of the U. S. National Museum, American Museum of Natural History, C. L. Remington, H. A. Freeman.

We had specimens of this species at the time we described *Megathymus beulahae* (*Lepid. news* 11: 113-137; 1958). At that time we considered it a subspecies of *beulahae*. It was not until we examined the genitalia that we realized this to be a separate species. The valva of the male genitalia is radically different from the valva of *beulahae*, resembling that of *yuccae* (Bdv. & Lec.). The female genitalia are also quite different, the constricted tips of the pads (papillae analis) being unique.

This species is easily distinguished from *Megathymus beulahae* by the reduction in size of the spots, particularly in the female, in which the discal band on the upper secondaries is limited to 4 spots. On the average *M. gayleae* hatches about 40 days later than *beulahae*.



Stallingsia jacki. Top row: HOLOTYPE ♀, Tuxtla Gutierrez, Mexico, 26 June 1958. 2nd row: ALLOTYPE ♂, Tuxtla Gutierrez, Mexico, 23 June 1958.
(Uppersides at left; undersides at right.)

Lower row: genitalia; left to right: ♂ uncus, ♂ valva, ♂ ædœagus, ♀ genital plate.

The foodplant is *Agave falcata* Engelm. and is closely related (if not the same) to the food plant of *beulahae*. Eggs are laid singly and are usually glued on the upper side of the leaf about one-third the way basad from the leaf tip. The larva in the final instar is ivory white and the caudal end is of the same color. We mention this last fact because we have another species of this group in which the caudal end of the larva is pinkish.

We found populations of this species, 25 to 50 miles west of Saltillo on Hwy. 40; 10 to 20 miles east of Saltillo on Hwy. 40; 73 miles north of Saltillo in the pass and on the north slope of the Sierra de la Gavia on Hwy. 57. The population west of Saltillo is subspecifically distinct as the spots are slightly larger than typical *M. gayleae* and the discal band of the female on the upper side of the secondaries often has more than 4 spots.

This species is named for GAYLE TURNER, daughter of the second named author and niece of the other two authors.

STALLINGSIA JACKI Stallings, Turner, & Stallings, NEW SPECIES

Female: upper surface of primaries: deep chocolate brown; all spots red brown, lighter than ground color; spot 1 (cell spot) a thin crescent with tips faced inward; spots 2, 3, & 4 (subapical spots) with spot 3 set inward from other two; spots 5 & 6 (submarginal spots) small, with spot 6 set inward from spot 5; spots 7 & 8 (with spot 9 making the discal band) round, with spot 7 directly above spot 8; spot 9 consisting of two diagonal bars just failing to join to form a "V" with base pointed inward; fringes well checkered brown-black and white.

Under surface of primaries: deep yellow brown without margin faintly overscaled with white; spot 2 white with some brown overscaling; all other spots light yellow brown with some brown overscaling, particularly in center of each spot, except spot 9 which lacks this overscaling; spot 5 is edged with some white scales; all spots larger on under side, particularly spot 9.

Upper surface of secondaries: deep choclate brown with pure white fringe.

Under surface of secondaries: brown-black overscaled with white; heavier along outer margin and in discal area, giving a slight banded effect.

Abdomen and thorax dark brown above and darker below. Palpus white with brown scales. Antenna with club brown-black and remainder brown-black narrowly ringed with light brown.

Measurements of Holotype: forwing, apex to base 26 mm., apex to outer angle 17.5 mm., outer angle to base 17.5 mm.; hindwing, base to end of vein Cu_1 18 mm.

Male: Upper surface of primaries: brown-black; all spots yellow with brownish tint and arranged as in ♀, except smaller; a few yellow hairs at base and extending outward towards outer angle; fringes well checkered brown-black and white.

Under surface of primaries: as above, with ground color a bit lighter, with spots larger, and with white overscaling on outer margin; spots 2 & 3 white.

Upper surface of secondaries: slightly darker than primaries with pure white fringe and with small pad of long black hairs in mid-costal area.

Under surface of secondaries: like ♀ but with more white overscaling, which increases the banded effect.

Abdomen, thorax, palpus and antenna as in ♀ but having whitish at base of antennal club.

Measurements of Allotype: forewing, apex to base 21 mm., apex to outer angle 17 mm., outer angle to base 17 mm., hindwing, base to end of vein Cu_1 17.5 mm.

Described from 4 specimens (1 ♂ and 3 ♀♀) reared from larvae collected near Tuxtla Gutierrez, Chiapas, Mexico at Km. 1081 at an elevation of 2500 ft.; emerged in confinement from 14 June to 2 July, 1958. The larvae were collected in August of 1957 by Dr. & Mrs. R. C. TURNER, DEE, JACK, VIOLA and DON B. STALLINGS.

HOLOTYPE: female, 26 June 1958, and ALLOTYPE, male, 23 June 1958, are in the collection of the authors.

The foodplant appeared to be a *Manfreda* much like the food plant of what we consider to be *Stallingsia smithi* (Druce) found at Guadalajara, Jalisco, Mexico. The colony of foodplants was found in a small clearing in the jungle and the larvae were discovered by JACK STALLINGS after the rest of us had given up finding anything in the plants.

This is the third described species of this genus and is found farther south than either of the other two, being close to Guatemala. It is distinguished from S. *smithi* by its smaller size and in the female by the deep chocolate brown ground color and in the male by the brown-black ground color. S. *smithi* does not have the ground color so dark, nor does it have the reddish cast as it's brown has a more yellowish tint. S. *smithi* has much more overscaling of yellow hairs on the upper surface of both sex. It is distinguished from *Stallingsia maculosus* (H. A. Freeman) by its larger size and though S. *maculosus* has a ground color with a reddish cast it is not as deep in color as S. *jacki*. Spots 7 and 8 of S. *maculosus* are elongated, while in this new species they are round.

The genitalia of this genus have several unique characters not shared with the other genera, particularly the relative length of the male ædœagus and the thick muscular tube (bursa?) attached to the vaginal plate, which had to be cut away before photographing in order to show the lower area of the plate. In *smithi* the terminal end of the ædœagus has a flange on each side, each flange terminating with two spines. *Maculosus* has the two flanges, each terminating in a single long slender spine. In this new species each flange terminates with a single spine which has a broad base, unlike *maculosus*. Later we expect to publish a paper devoted to the genitalia of the Megathymidae and will go into more detail as to the characters of the genitalia of this and related species.

This species is named for JACK STALLINGS, the son of the first and last named authors, whose perserverance was rewarded by the discovery of this species.

MEGATHYMUS YUCCAE REUBENI Stallings, Turner, & Stallings, NEW SUBSPECIES

Female: upper surface of primaries: bright black with yellow green hairs near base; outer margin from apex to outer angle heavily overscaled with white; spot 1 square; spots 2, 3, & 4 of equal length and in vertical allignment; spots 5 & 6 large and squarish; spot 7 shorter than 8; spot 9 about same length as 8, but toothed inwardly; spots 2, 3 & 4 white, spots 5 & 6 creamy white, spots 1, 7, 8, & 9 creamy yellow; fringes checkered light smoke and black.

Under surface of primaries: black with outer margins heavily overscaled with white; All spots of the upper side reappear, with spots 2, 3, 4, 5, & 6 white and spots 1, 7, 8, & 9 creamy white.

Upper surfaces of secondaries: bright black with yellow-green hairs near base; discal band well defined and brighter yellow than spots on primaries; with creamy-white border, 3 mm. wide; fringes white.

Under surface of secondaries: black with costal area and outer margin heavily overscaled with white; with two large triangular white spots in the costal area and a small white spot in center of wing; discal band is represented by heavy whitish overscales, in part outlined in black.

Abdomen bright black above, dark gray to black below; thorax dark gray above, lighter below; palpus almost pure white; antennal club above black and shaft white with faint black rings near base, below all white except tip of club.

Length of forewing 28 mm. to 35 mm., average 32 mm. Measurements of Holotype: forewing, apex to base 32 mm., apex to outer angle 20.5 mm., outer angle to base 22 mm.; hindwing, base to end of vein Cu_1 23 mm.

Male: Upper surface of primaries: flat black, similar to ♀ with spots smaller and lighter color; spots 1, 2, 3, 4, 5, & 6 white; spots 7, 8, & 9 toothed inwardly.

Under surfaces of primaries: similar to ♀ with spots white, except 7, 8, & 9 which are creamy white.

Upper surface of secondaries: similar to ♀ but without discal band and veins in outer black area edged with creamy white.

Under surface of secondaries: similar to ♀ but without discal band.

Abdomen, thorax, palpus, and antenna same as in ♀.

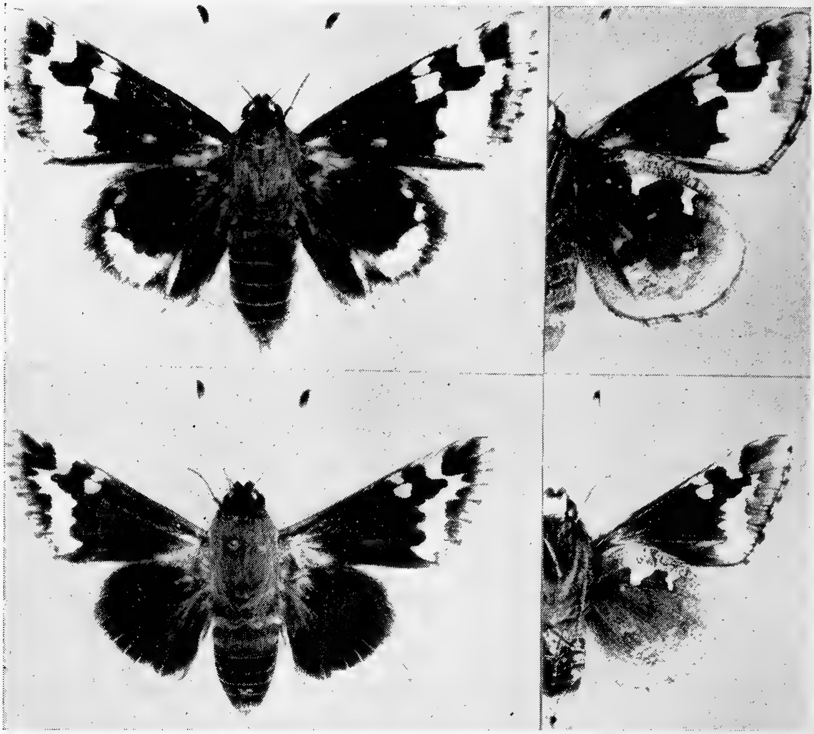
Length of forewing 24. mm. to 30 mm. average 27.5 mm. Measurements of Allotype: forewing, apex to base 27.5 mm., apex to outer angle 17.5 mm., outer angle to base 20 mm.; hindwing, base to end of vein Cu_1 18.5 mm.

Described from 36 specimens (12 ♂♂ and 24 ♀♀) reared from larvae and pupae, collected by Dr. & Mrs. R. C. Turner, Dee and Jack Stallings, and the authors, at an elevation of 5300 feet in the Hueco Mts. of Texas, emerging in confinement from 21 Jan. to 8 April, 1956, 1957 and 1962. The pupal cases are made a part of the type series.

HOLOTYPE, female, 25 March 1962, and ALLOTYPE, male, 25 March 1962, are in the collection of the authors. Paratypes are deposited in the collections of C. L. Remington, H. A. Freeman, U. S. National Museum, and the American Museum of Natural History.

Foodplant: *Yucca baccata* Torrey; sometimes *Yucca elata* Engelman.

This subspecies occurs throughout the Hueco Mts. We also have a single specimen of a very similar individual from the Big Bend area of Texas collected as a larva in *Yucca torreyi* Shafer near Shafter, Texas. Strangely, it emerged 8 Sept. 1957.



Megathymus yuccae reubeni. Top row: HOLOTYPE ♀, Hueco Mts., Texas, 25 Mar. 1962. Bottom row: ALLOTYPE ♂, Hueco Mts., Texas, 25 Mar. 1962. (Uppersides at left; undersides at right.)

We, along with H. A. FREEMAN, are aware that there is more than one species involved in the complex known as *Megathymus yuccae* (Bdv. & LeC.) and its many subspecies. In fact, preliminary work by Drs. REMINGTON and SAITOH with chromosome counts indicates that *M. yuccae* is confined to an area east of the Mississippi. This situation will soon be treated in a paper by the first named author and H. A. FREEMAN.

M. yuccae reubeni is distinguished from all other subspecies by its "blonde" appearance. Nearest to it are *M. yuccae coloradensis* Riley and *M. yuccae arizonae* Tinkham. It is distinguished from the first by its larger size and lighter color and from the second by its lighter color and heavy white overscaling in the outer margins.

This subspecies is named for Dr. REUBEN C. TURNER, father of the last two named authors, who was planning an expedition to collect further specimens of this subspecies at the time of his death in 1958.

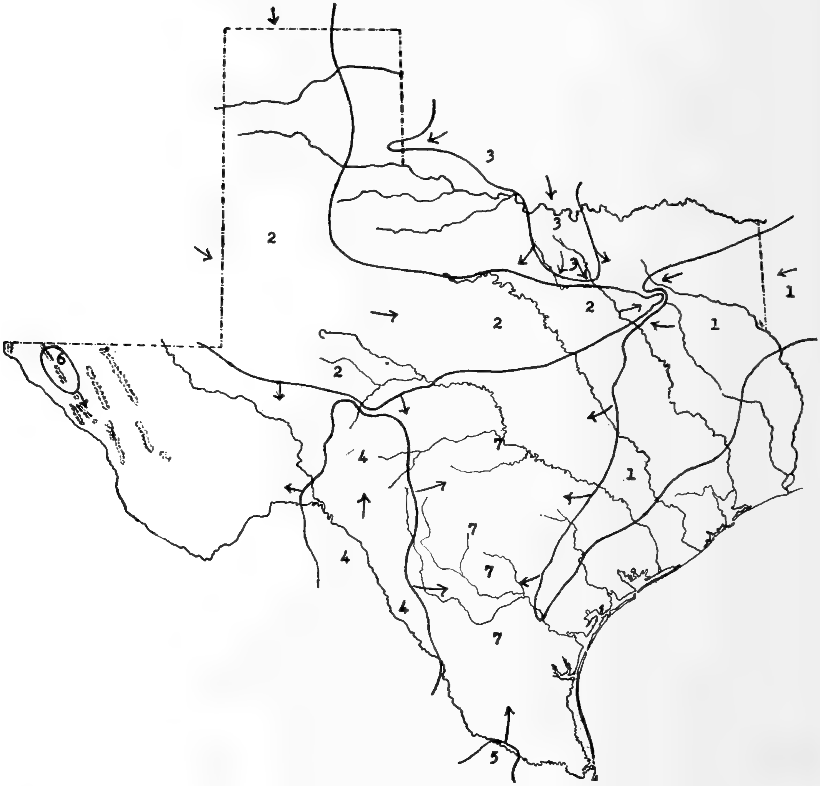
Caldwell, Kansas, U. S. A.

MEGATHYMUS YUCCAE IN TEXAS, WITH THE DESCRIPTION OF TWO NEW SUBSPECIES

by H. A. Freeman

After many hours of thought and discussion Don B. Stallings and I have reached the following conclusions concerning the arrangement of the various subspecies of *Megathymus yuccae* (Bdv. & Lec.) in the state of Texas. We have been working with this group for nearly twenty years, and there was a time when we had a few specimens of *yuccae* from isolated locations over the state and these clearly told us the complete story of *yuccae* in this area. Now that we have nearly five thousand specimens of Megathymidae in our separate collections the clarity of the picture dims. Since receiving a research grant from the National Science Foundation I have been making every effort to approach this problem from a strictly scientific viewpoint. There are so many factors that seem to have brought about the production of subspeciation in this group that I have been trying to associate these factors together so as to arrive at some definite conclusions. In the various habitats that I have been studying over the state such things as plant associates, type of soil, pH of soil, elevation, average rainfall, and whether or not there is any indication of radiation present, have been checked and recorded. These factors certainly seem to have had some influence upon the particular subspecies found in any given area. Genetically speaking there appear to be two major influences affecting the Texas populations, from *coloradensis* to the west and from *yuccae* to the east, while from the south comes a minor influence of *wilsonorum*. Environmental factors may have influenced the production of minor mutations that have survived and these increased through the years due to isolation of various stands of *Yucca*, thus building up factors that would produce eventual subspecies. I have no doubt that we are seeing seconds unfold in the millennium required to change these subspecies into species.

Whether we are dealing with a single superspecies or a number of sibling species is a question that cannot be definitely decided at the present; however, to me, it appears that *coloradensis* Riley and *yuccae* have progressed to the point in evolution where they actually constitute two separate species. Being unable to prove this at the present I will consider them to be conspecific in dealing with the classification of the *yuccae* group in Texas. The map shows the general distribution of the various subspecies of *yuccae* in Texas.



THE RANGE OF THE VARIOUS SUBSPECIES OF *Megathymus yuccae* IN TEXAS

1. *Megathymus yuccae reinthali* Freeman
2. *Megathymus yuccae coloradensis* Riley
3. *Megathymus yuccae stallingsi* Freeman
4. *Megathymus yuccae louiseae* Freeman
5. *Megathymus yuccae wilsonorum* Stallings & Turner
6. A new subspecies being described by STALLINGS and TURNER
7. A "flux" area where the specimens seem to show characteristics of more than one subspecies.

In the eastern part of Texas, extending from just southwest of Texarkana over to Mt. Pleasant, down to Canton and Buffalo and over to all the Ben Wheeler, Crow and Tyler area there are found individuals that seem to represent the western extension of *yuccae yuccae;* however they seem to indicate a blending together of some of the characteristics of *yuccae yuccae coloradensis,* especially the specimens from two miles west of Ben Wheeler. Since these specimens seem to have characteristics more or less their own, I am naming this population as follows.

MEGATHYMUS YUCCAE REINTHALI Freeman, NEW SUBSPECIES

FEMALE. Upper surface of primaries: shiny black, with a heavy orange-yellow overscaling at the base of the wings. There is a narrow white overscaled area along the outer margin near the apex. Spot 1 (cell spot) is broadly rectangular, with the lower inner side elongating out into a point directed towards the base of the wings and being orange-yellow in color. Spots 2, 3, and 4 are white and broadly rectangular. Spots 5 and 6 are prominent and squarish in shape, being deep yellow in color. Spots 7 and 8 are broadly rectangular (4-5mm. wide) and are deep orange-yellow in color. Spot 9 is broadly triangular with the inner edge usually a little wider than the two spots above and it is of the same color. Spot 7 is situated slightly under the inner edge of spot 6. There is a faint orange spot located two-thirds of the way in towards the base from spot 9. Fringes are checkered gray and black. Under surface of primaries: dull black, with the outer margin overscaled with white. All spots reappear and are of about the same color as above.

Upper surface of secondaries: shiny black, with some orange-yellow hairs and scales near the base. There is a dark yellow marginal border varying from 2-3mm. wide. Spots 10 and 11 are fused together into a large orange-yellow spot. Spots 12 and 13 are square. averageing 2mm. across and are orange-yellow. There is usually a rather prominent phantom spot in space 14 of above the same color as the other spots. The fringes are dark yellow. Under surface of secondaries: dull black over the basal and discal areas. The outer portion of the costal area overscaled with grayish-white scales and there is a slight overscaling of gray along the outer margin. There are two white subcostal spots and some specimens may have one or two white spots below these nearer the center of the wing.

Abdomen black above, gray beneath. Thorax black above lighter beneath. Palpi clear white. Antennae have the club black with some white beneath; the remaining portion is black ringed with white above and nearly all white beneath.

Length of forewing varies from 31 to 37 mm., average 34 mm. Wing measurements of Holotype: forewing, apex to base 34 mm., apex to outer angle 20 mm., outer angle to base 25 mm.; hindwing, base to end of vein Cu_1 24 mm.

MALE. Upper surface of primaries: shiny black, with a heavy overscaling of orange-yellow hairs and scales at the base. There is a slight, narrow grayish overscaling near the apex. The orange-yellow cell spot (spot 1) is fairly large and there are three small linear white spots above it. Spots 2, 3 and 4 are white and fairly broad. Spots 5 and 6 connect by a narrow line to the subapical spots and are light yellow in color. Spots 7 and 8 are fairly broad, extending about halfway under spot 6 and are orange-yellow in coloration. Spot 9 is slightly pointed inward toward the base of the wing and is of the same color as 7 and 8. The fringes are gray and black. Under surface of primaries: dull to shiny black, with the overscaling of gray near the apex much more extensive than above. The spots all reappear and are slightly lighter in coloration.

Upper surface of secondaries: shiny black, with some orange-yellow hairs and scales near the base. There is an orange-yellow marginal border 2 to 2.5mm. wide. Some specimens show one or two discal spots of the same color as the border, however most do not have this. Fringes dark yellow. Under surface of secondaries: similar to the female, except there is often but a single subcostal white spot and the small white spot or spots that sometimes shows up in the female beneath the subcostal spots are absent.

Abdomen gray above, with a few orange-yellow hairs present, dull black beneath. Thorax black above, somewhat lighter beneath. Palpi clear white. Antennal club black, except at the base. above and white beneath; the remainder white, slightly ringed with black above.

Length of the forewing varies from 22 to 29 mm., average 28 mm. Wing measurements of the Allotype: forewing, apex to base 28 mm., apex to outer angle 17 mm., outer angle to base 20 mm.; hindwing, base to end of vein Cu_1 18.5 mm.

Top row: *M. yuccae louiseae* ALLOTYPE ♂, 16 miles n. Del Rio, Texas, 2 May 1960.
2nd row: *M. yuccae louiseae* HOLOTYPE ♀, 16 miles n. Del Rio, Texas, 5 May 1960.
3rd row: *M. yuccae reinthali* ALLOTYPE ♂, two miles w. Ben Wheeler, Texas, 23 Mar. 1961.
Lower row: *M. yuccae reinthali* HOLOTYPE ♀, two miles w. Ben Wheeler, Texas, 28 Mar. 1961.

Described from 89 specimens (52 males and 37 females). 84 of these specimens were collected by the author at the following locations in Texas: 2 miles west of Ben Wheeler (Van Zandt Co.) Texas, el.410 feet, pH 5 (type locality), 10 ♂♂, 8 ♀♀ from *Yucca louisianensis* which emerged March & April 1956-58-60-61; 8.8 miles s. Canton (Van Zandt Co.), el.500 feet, pH 5, from *Y. louisianensis*, 2 ♂♂, 1♀, March 1958, and 100 yards from this area in *Yucca freemanii*, pH 4.9, 6 ♂♂, 4 ♀♀, March 1952-53-54-56-58; 3.5 miles n.e. Crow (Wood Co.), el.500 feet, pH 5, in *Y. louisianensis*, 7 ♂♂, 3 ♀♀, March & April, 1950 & 1958; 1 mile n. Crow, el.490 feet, pH 5, in *Y. louisianensis*, 1♂, 2 ♀♀, April 1958; 2 miles n.w. Buffalo (Leon Co.), el.390 feet, pH.5, in *Y. louisianensis*, 2 ♂♂, 2 ♀♀, March & April 1951-56-57: Tyler State Park (Smith Co.), el.360 feet, pH 5, in *Y. louisianensis*, 20 ♂♂, 16 ♀♀, March & April 1950-51-52-53-58-59-60-61. Four specimens were collected as larvae in *Y. louisianensis* by Stallings and Turner at Oakwood (Leon Co.), Texas (emerged during March 1952), and Tyler, Texas (same date); 1♀ Luling, Texas, 24 March 1952.

HOLOTYPE female, two miles w. Ben Wheeler, Texas, 28 March 1961, reared in *Yucca louisianensis;* ALLOTYPE male, same location and food plant, 23 March 1961; both were collected by the author and are in his collection. Two pairs of Paratypes will be placed in the Stallings and Turner collection and one pair each will be placed in the American Museum of Natural History and the collection at Yale University. The rest of the Paratypes are in the collection of the author.

I take pleasure in naming this new subspecies for my good friend Dr. W. J. Reinthal who did some work on this butterfly while he was living in Texas.

This is the subspecies which is found in or near woods, especially where pines and oaks occur. All specimens were located in areas where the pH was 5 or slightly below, indicating an acid relationship. All the other subspecies of *yuccae* occur in nearly neutral or alkaline soil in the state. This is a sandy soil subspecies.

In comparing this subspecies with typical *yuccae* from Georgia, the ground color is more of a shiny black color in *reinthali;* even though the wing shape is broad it is not as broad as typical *yuccae;* the maculation is somewhat different; and even though the color of the spots, overscaling near base of wings and marginal border of secondaries is dark yellow it is still not as dark as some of the specimens of typical *yuccae.* For a comparison with the other subspecies refer to the keys.

Megathymus yuccae coloradensis Riley

This very extensive subspecies or species covers a rather wide area north and west of Texas and only enters the state as typical *coloradensis* in the Panhandle area. I collected two specimens on the wing in the Palo Duro Canyon that appear to be very much like specimens collected around Colorado Springs, Colorado (type locality). The apparent food plant of *coloradensis* in the Palo Duro Canyon is *Yucca glauca,* as that was the only species of *Yucca* that I observed in the area. The soil is rocky and shows red clay and some limestone outcropping in various regions of the canyon. The pH was 6.8, indicating nearly neutral soil.

There is a wide area extending into Texas from New Mexico which passes through San Angelo and extends through Stephensville, Glen Rose, Walnut Springs, Waxahachie over to near Ben Wheeler where the specimens appear to have received a decided *coloradensis* influence at sometime during the past. This is characterized by wing shape and pattern of maculation. Genitalic tendencies are towards that apparent supersubspecies. In this particular group the genitalia seem to fall into definite regional patterns with considerable amounts of variation present within each region, indicating that a considerable amount of evolution is in progress there. In this broad strip the specimens feed on the following species of *Yucca*: *rupicola, pallida, louisianensis,* and a hybrid of *arkansana* × *pallida.*

Megathymus yuccae stallingsi Freeman

This subspecies covers a restricted part of Texas, as indicated on the distributional map. It is associated with limestone soil in most areas that has a pH of 7.2 to 7.8, indicating an alkaline relationship. The most popular food plant is *Yucca arkansana,* however in certain areas it feeds upon *Yucca pallida,* especially around Cedar Hill (south-western Dallas Co.) which just about constitutes its southern limit. This subspecies is more or less common in the region indicated and often will be found in urban areas as well as in the open country, especially if it was originally prairie country. In the Dallas area there were several large colonies present ten years ago, one on Buckner Boulevard near the Drive-in Theater and near Lancaster there were several nice colonies. Extensive building of new homes has just about eliminated all of these habitats. Plants often associated with it are mesquite, cedars, elms and Johnson grass.

Specific differences making it possible to recognize this subspecies can be noted in the keys.

I have been working for some time on the particular group of individuals that have been found from Mertzon southward through Sonora to Del Rio and westward to five miles west of Langtry, Texas, where they apparently stop. This entire area is covered by individuals that seem to have distinctive subspecific characteristics. Extending southeast of Del Rio to Laredo and over into Mexico around Allende, Coahuila, are found specimens that show a decided relationship to this particular subspecies, however I am not including them in the original description of this new subspecies, merely indicating that they possibly should be associated with them since more study of the area is needed.

MEGATHYMUS YUCCAE LOUISEAE Freeman, NEW SUBSPECIES

FEMALE. Upper surface of primaries: flat black, with some faint grayish-yellow overscaling near base of wings. There are a few white scales along the outer margin near the apex. Spot 1 (cell spot) is somewhat square and yellowish-white. The subapical spots (2, 3 and 4) are white, and all the others are yellowish-white, with spots 5 and 6 (submarginal spots) paler than the others. Spot 7 is square on three sides and rounded on the outside. Spot 8 is similarly shaped, however it is slightly smaller in size. Spot 9 is somewhat triangular with the apex sharply pointing toward the base of the wings. Spot 7 is situated just beneath the inner edge of spot 6. All three discal spots show an even gradual curve inward with spot 9 being somewhat nearer the base of the wings than the two above. The fringes are checkered sordid white and black. Under surface of primaries: black, with the entire outer margin overscaled with grayish-white scales. All spots reappear and are of about the same general coloration as above.

Upper surface of secondaries: black, with a few yellowish-gray hairs near the base. The marginal border is medium in width, being sordid white blending into gray. The discal spots are reduced, 10 and 11 are mere dots, whereas 12 and 13 are better defined and somewhat rounded on their outer surfaces. Sometimes a phantom spot shows up in space 14. The fringes are sordid white. Under surface of secondaries: Grayish-black, rather heavily overscaled with grayish scales, especially along the margin and near the costa. There is a well defined white subcostal spot and about half of the specimens have a minute, linear spot outside of this one.

Abdomen grayish-black above, gray beneath. Thorax grayish-black above, lighter beneath. Palpi are sordid white. Antennal club black with some white beneath, the remaining portion is black ringed with white above and nearly all white beneath.

Length of forewing varies from 30 to 35 mm., average 33 mm. Wing measurements of Holotype: forewing, apex to base 34 mm., apex to outer angle 20 mm., outer angle to base 22 mm.; hindwing, base to end of vein Cu_1 22.5 mm.

MALE. Upper surface of primaries: flat black, with a faint, light gray overscaling at the base. There is a narrow overscaling of white scales near the apex. Cell spot (spot 1) is small and somewhat oval. Spots 2, 3, and 4 are white and well defined. Spots 5 and 6 are white and fairly well defined. Spots 7, 8 and 9 are shaped somewhat like those in the female only smaller and are yellowish-white in color. Spot 7 reaches just to the inner edge of spot 6. The fringes are sordid white and black. Under surface of primaries: black, with the outer margin overscaled with grayish-white scales. All spots reappear and are lighter, being nearly all white.

Upper surface of secondaries: black, with a few grayish hairs near the base. The marginal border is medium in width and is sordid yellowish-white. Fringes are white. Under surface of secondaries: very similar to the female, except the second subcostal spot is a little better defined.

Abdomen, thorax, palpi and antennae are the same as in the female.

Length of forewing varies from 25 to 29 mm., average 27 mm. Wing measurements of the Allotype: forewing, apex to base 27 mm., apex to outer angle 16 mm., outer angle to base 18 mm.; hindwing, base to end of vein Cu_1 16 mm.

Described from 63 specimens (35 males and 28 females) all reared from larvae. Seven specimens were collected by STALLINGS and TURNER, six miles north of Del Rio, Texas, in *Yucca thompsoniana*. These emerged during February and March 1955. The remaining 56 specimens were collected in Texas by the author at the following locations: 5.5 miles w. of Mertzon (Irion Co.), el.2300 feet, pH 7.1, in *Yucca campestris* & *Yucca reverchoni;* 10 miles s. Christoval (Tom Green Co.), el.1850 feet, pH 7, in *Y. reverchoni;* 50.5 miles n. Del Rio (in Edwards Co.), el.2100 feet, pH 7.2, in *Y. reverchoni;* 28 miles n. Del Rio (Val Verde Co.), el.1500 feet, pH 7.1, in *Y. reverchoni* & *thompsoniana;* 16 miles n. Del Rio (type locality), el.1450 feet, pH 7.1, in *Y. reverchoni, Y. torreyi,* & *Y. thompsoniana* (host plant of Holotype and Allotype); 6 miles n. Del Rio, el.1050 feet, pH 7.1, in *Y. torreyi, Y. reverchoni* & *Y. thompsoniana;* 12 miles s. Juno (Val Verde Co.), el.1450 feet, pH 7.1, in *Y. thompsoniana* and *Y. torreyi;* Comstock (Val Verde Co.), el.1550 feet, pH 7.5, in *Y. thompsoniana;* east side of the Pecos River Canyon (Val Verde Co.), el.1400 feet, pH 7, in *Y. thompsoniana;* and 5 miles w. of Langtry (Val Verde Co.), el.1350 feet, pH 7, in *Y. thompsoniana.* These emerged during February through May of 1960 and 1961.

HOLOTYPE, female, 16 miles north Del Rio, Texas, 5 May 1960, reared in *Yucca thompsoniana;* ALLOTYPE, male, same location and food plant, 2 May 1960; both were collected by the author and are in his collection. Paratypes will be placed in the Stallings and Turner collection, American Museum of Natural History and the collection at Yale University.

I take pleasure in naming this new subspecies for my wife who has helped me greatly in my work on the Megathymidae.

This is the subspecies that is found west and southwest of the Edwards Plateau, in Texas, where the soil is rocky and has a pH of from 7 to 7.5. Some of the plants found in the same area where *louiseae* occurs are scrub cedars, mesquite, sotol, ocatilla, *Mahonia,* cat claw, various cacti, and in some areas *Agave lecheguilla.* The predominant food plant is *Yucca thompsoniana.*

In comparing this subspecies with *M. yuccae wilsonorum,* its nearest relative, the wing shape is slightly different, not being as narrow as in *wilsonorum;* the disposition of spots 7, 8 and 9 are slightly farther out towards the outer margin in *louiseae;* the coloration is somewhat lighter in *louiseae;* and the discal band of spots on the secondaries of the females

are more definite in *louiseae* than in *wilsonorum*. For a comparison with the other subspecies refer to the keys.

Megathymus yuccae wilsonorum Stallings & Turner

This Mexican subspecies, or possibly a sibling species, enters the United States only in a narrow strip extending from Rio Grande City to near Mission, Texas, where it feeds only in plants of *Yucca treculiana*. In the areas that I collected in during December of 1959 and 1960 I found most of my specimens in sandy soil around Sullivan City, el.150 feet, and near Rio Grande City, el.230 feet. The soil that I tested ran from pH 7.3 to 7.5. This subspecies occurs in rather thick brushy country which makes the discovery of tents rather difficult.

I am of the opinion that this subspecies is not closely related to either *M. yuccae yuccae* or *M. yuccae coloradensis* but represents another major subspecies complex. I base my conclusions on wing shape, maculation, and the type of habitat that it favors.

M. yuccae wilsonorum has a decided influence on specimens of *yuccae* from the San Antonio and vicinity as well as the specimens collected around Hondo. This entire area extending from San Antonio to near Stephensville and over to Waxahachie has specimens present that have some characteristics of all the subspecies found in the state except those from the extreme southwestern part of the state, and Don Stallings and I agree that this is a flux area where genes from many areas seem to flow together to produce specimens that cannot properly be placed into any given subspecies. This flux area is No. 7 on the distributional map.

Stallings and Turner are working on a new subspecies from the extreme southwestern part of Texas, and I am mentioning it only so as to record its presence by No. 6 on the distributional map.

WING SHAPE COMPARISON OF VARIOUS SUBSPECIES OF *MEGATHYMUS YUCCAE*

	reinthali		*stallingsi*		*wilsonorum*		*louiseae*		*coloradensis*	
Primaries	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Base to apex	27*	31	27	31	27	33	27	31	27	31
Apex to outer angle	17	19	16	18	14	19	16	18	17	29
Outer angle to base	19	23	19	23	15	22	18	22	19	20
Secondaries										
Base to end of Cu_1	18	23	16	22	14	22	16	21	18	23
	(broad)		(medium)		(very narrow)		(narrow)		(broad)	

*Measurements in millimeters.

KEY TO THE MALES OF THE SUBSPECIES OF *MEGATHYMUS YUCCAE* IN TEXAS

la. Ground color dark, shiny black above 2
lb. Ground color flat black above 3
lc. Ground color brownish-black above wing shape broad; spots above light yellow; heavy light yellow overscaling at base of primaries; spot 7 extends half-way beneath spot 6; cell spot large; marginal border of secondaries wide and light yellow; one crescentic spot and a curved line beneath costa on lower surface of secondaries; average size 50 mm. .... *coloradensis*

2a. Wing shape broad; spots above dark yellow; heavy dark yellow overscaling at base of primaries; spot 7 reaches inner edge of spot 6; cell spot large; marginal border of secondaries medium in width and dark yellow; usually one subcostal spot on lower surface of secondaries; average size 61 mm. .... *reinthali*
2b. Wing shape medium; spots above lemon yellow; faint lemon yellow overscaling at base of primaries; spot 7 reaches inner edge of spot 6; cell spot large; marginal border of secondaries narrow and lemon yellow; usually two subcostal spots on lower surface of secondaries; average size 55 mm. .... *stallingsi*

3a. Wing shape very narrow; spots above dull lemon yellow; heavy dull lemon yellow overscaling at base of primaries; spot 7 does not reach inner edge of spot 6; cell spot small; marginal border of secondaries wide and dull lemon yellow; usually one subcostal spot on lower surface of secondaries; average size 61 mm. .... *wilsonorum*
3b. Wing shape narrow; spots above sordid yellowish-white; faint light gray overscaling at base of primaries; spot 7 barely reaches inner edge of spot 6; cell spot small; marginal border of secondaries medium and sordid yellowish-white; two subcostal spots on lower surface of secondaries; average size 57 mm. .... *louiseae*

KEY TO THE FEMALES OF THE SUBSPECIES OF *MEGATHYMUS YUCCAE* IN TEXAS

la. Ground color dark, shiny black above 2
lb. Ground color flat black above 3
lc. Ground color brownish-black above; wing shape broad; spots above light yellow; heavy yellowish overscaling near base of primaries spot 7 reaches nearly to outer edge of spot 6; cell spot rectangular, with lower inner edge pointing towards base of primaries; spots 7, 8 and 9 very broad, all about equal width; fringes of primaries yellow, very faintly checkered with brown scales; discal spots of secondaries large and fused together, usually a pronounced phantom spot in spece 14; marginal border of secondaries very broad and yellow; under surface of secondaries mottled light and dark; average size 58 mm. .... *coloradensis*
2a. Wing shape broad; spots above dark yellow; heavy orange-yellow overscaling at base of primaries; spot 7 reaches well under spot 6; cell spot large, rectangular with lower inner edge pointing towards the base of the wings; spots 7, 8 and 9 broad, of about equal width; fringes of primaries checkered dark and deep yellow; discal spots of secondaries well developed, 10 and 11 fused together, other there is a phantom spot in space 14; marginal border of secondaries medium in width, dark yellow; under surface of secondaries browish-black over discal area, gray around costa and margin; average size 69 mm. .... *reinthali*

2b. Wing shape medium; spots above lemon yellow; faint grayish-brown overscaling near base of primaries; spot 7 reaches under inner edge of spot 6; cell spot medium in size, irregularly square; spots 7 and 8 fairly broad, with spot 9 broadly triangular, with the apex pointing inward; fringes of primaries black, faintly checkered with gray scales; discal spots of secondaries well developed, 10 and 11 usually fused; marginal border of secondaries narrow, yellowish gray; under surface of secondaries even brownish-black, with gray around margin; average size 65 mm. .... *stallingsi*

3a. Wing shape very narrow; spots above yellowish-white; fairly heavy grayish-yellow overscaling near base of primaries; spot 7 does not reach inner edge of spot 6; cell spot medium, somewhat square; spots 7 and 8 narrow, above equal size, spot 9 triangular with apex pointing inward; fringes of primaries distinctly checkered dark gray and sordid white; discal spots of secondaries greatly reduced, 10 and 11 usually absent; marginal border of secondaries broad, light yellow; under surface of secondaries grayish-black, darker over the discal area and lighter around the costa and margin; average size 74 mm. .... *wilsonorum*

3b. Wing shape narrow; spots above yellowish-white; faint grayish-yellow overscaling near base of primaries; spot 7 reaches to inner edge of spot 6; cell spot medium, somewhat square; spots 7 and 8 fairly narrow and of about equal size, spot 9 broadly triangular with the apex pointing inward; primaries have the fringes distinctly checkered black and sordid white; discal spots of secondaries reduced, 10 and 11 mere dots, sometimes a phantom spot appears in space 14; marginal border of secondaries medium in width, sordid white blending into gray; under surface of secondaries even grayish-black, with some lighter gray around margin and near the costa; average size 69 mm. .... *louiseae*

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TYPOGRAPHICAL ERROR IN McDUNNOUGH BIOGRAPHY

Due to a printer's error in a final stage of preparing volume 16: no.4 of the *Journal* for printing, a false line was substituted in place of the right one and a nonsense sentence resulted in D. C. FERGUSON's biographical obituary of J. H. McDUNNOUGH. The first sentence of the second new paragraph on page 217 should read:

"Dr. McDUNNOUGH was an Honorary Life Member of the Lepidopterists' Society and a cordial and helpful friend to the early moves towards its formal establishment."

Our apologies to Mr. FERGUSON.

C. L. REMINGTON

A NEW SUBSPECIES OF *HOLOMELINA AURANTIACA* FROM VIRGINIA (ARCTIIDAE)

by ALEX K. WYATT

The late OTTO BUCHHOLZ and I were both greatly interested in the genus *Holomelina* (=*Eubaphe* of authors; see Fletcher, 1954, *Zoologica* 39: 155) and reared many of the eastern species and forms. We exchanged views and specimens freely, not always agreeing on specific identities. Among specimens I received from him was a small series bred from a female taken by him at Suffolk, Virginia on June 10, 1941. I saw him a few years later and expressed the opinion that it was entitled to subspecific rank and should be named. He was rather non-committal about it and, I believe, left it under *aurantiaca* without special characterization. Not wishing to assume what I regarded as his prerogative, I left my small series in the same situation.

Meeting Dr. FREDERICK H. RINDGE in Chicago recently, I suggested to him that I would like to describe and name the Suffolk form, probably as a subspecies of *aurantiaca*. Dr. RINDGE suggested that if I decided to do so, he would send me the Buchholz series for examination and study. This was done and I now take pleasure in describing the form as:

HOLOMELINA AURANTIACA BUCHHOLZI Wyatt, NEW SUBSPECIES

Males: All clear yellow (golden ochre) at first glance and apparently rather thickly scaled. About one-fourth of the specimens show the very faintest trace of pink, which is emphasized on the underside of primaries. None show discal marks on either primaries or secondaries. Three out of forty-two specimens show faint indications of dark submarginal markings on the hind wings. Expanse of males: 20 to 23 mm.

Females: Parent female closely resembles some females of *rubicundaria* or even *ferruginosa,* but is smaller than the latter. Primaries are light brown with a dark discal mark, a vague submarginal row of blurred dark spots, a longitudinal well-defined white spot, about two mm. long, above vein one, and just within the half-way mark between base and tornos. Secondaries are yellowish with a pink tinge, a heavy discal mark, and a broad ill-defined submarginal row of blackish spots not reaching the apex. Beneath, the primaries are slightly paler with the black markings reproduced on all wings. Of the reared females about one-half show the white spots of the primaries to a greater or lesser extent, one even having a white spot in the cell and a row of four small white spots beyond it parallel to the outer margin. Three other females show no white markings. Secondaries of all females show the black discal mark and submarginal band as in the parent, altho a few have these markings reduced in size. The pink tinge of secondaries varies and appears more strongly in some females. Expanse of females: 25 to 28 mm.

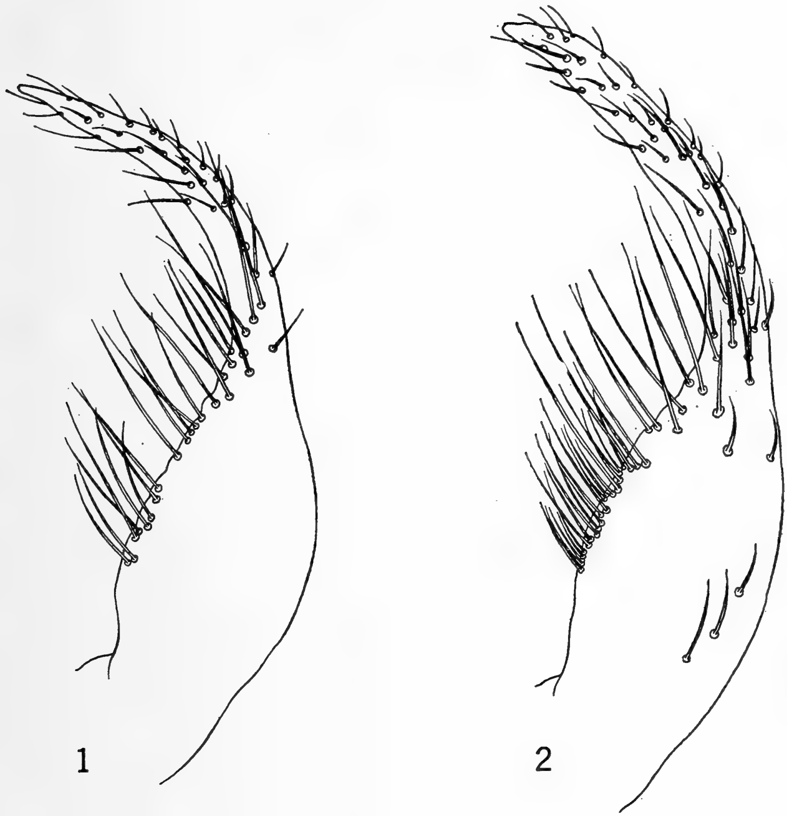

Fig. 1. Valve of *Holomelina aurantiaca* ssp. *rubicundaria*.
Fig. 2. Valve of *Holomelina aurantiaca* ssp. *buchholzi*.

Genitalia: Slides were made of both males and females and compared with those of *rubicundaria*, the subspecies most nearly resembling *buchholzi*. Among the females no apparent difference was noted. In *buchholzi* all male genitalia were alike. In *rubicundaria*, slides were made of specimens from Ontario to Florida and showed some variation, particularly in the curvature of the valves which was of shorter radius in the more northern specimens than in those from more southern regions. Setae appear to be slightly longer in *buchholzi* and denser on the inner side of the valves than in *rubicundaria*. Also there are a few setae along the outer side of the sacculus in *buchholzi* and one or two near the base on the outer side of the sacculus, which do not appear in *rubicundaria*. The illustration herewith will serve to show the differences in the genitalia.

Specimens examined: Field captures – all Suffolk, Va.: 1♂, VIII-10-1940; 1♀, VI-10-1941 (the brood parent); 2♂♂, VI-16-1941. Reared: 40♂♂, 66♀♀, VII-14 to VIII-4-1941.

Disposition of specimens: HOLOTYPE male: – Suffolk, Va., Aug. 4, 1941; ALLOTYPE female: – same locality, July 23, 1941; both in Chicago Natural History Museum. PARATYPES: 5♂♂, 5♀♀ in Chicago Natural History Museum; 2♂♂, 2♀♀ in collection of MURRAY O. GLENN, Henry, Illinois; 35♂♂, 59♀♀ in American Museum of Natural History.

My thanks are due to Mr. MURRAY O. GLENN of Henry, Illinois for his assistance in preparing slides of various specimens and to Dr. RUPERT WENZEL and Mr. HENRY DYBAS of the Chicago Natural History Museum for help in the preparation of this article and the illustrations.

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TWO RARE SPHINGIDAE FROM WESTERN PENNSYLVANIA

On 12 July 1961 I took a fresh male *Chlaenogramma jasminearum* (Guérin) 2 miles east of Morganza at Donaldson's Crossroads in Washington County. This specimen was caught flying around a gas station about 10:30 P.M. on a rainy night. On 30 July 1961, a warm clear night, JAMES MODERY took two fresh males at the same place. The year before, he also caught a worn female *C. jasminearum* just across the highway in July. During 1962, I caught two more male *C. jasminearum,* one at the same place as mentioned above, on 8 July. The other male, which was worn, was taken 14 July. The surrounding area is residential with small scattered woods. Ash trees are common in the area. According to TIETZ (*The Lepidoptera of Pennsylvania*: 24), the only known records of from the eastern part of the state.

A fresh male of the rare *Sphinx franckii* (Neumoegen) was taken by myself along Route 19 near Donaldson's Crossroads, Washington County on 6 July 1961. Another fresh male was taken at about the same place on 6 July 1962, and on 14 July 1962 JAMES MODERY caught a fresh male two miles east of Donaldson's Crossroads, the above locality. According to TIETZ, the only known previous record of *S. franckii* for the state was in Wayne, near Philadelphia.

The *C. jasminearum* caught 12 July 1961 and the *S. franckii* caught 6 July 1961 are both now in the Carnegie Museum.

RICHARD M. GILMORE, 105 McClintock Dr., Canonsburg, Penna., U. S. A.

SUPPLEMENTAL NOTES TO PREVIOUS TAXONOMIC NOTES ON SOME NEARCTIC RHOPALOCERA

by CYRIL F. DOS PASSOS

Since the publication of "Taxonomic Notes on some Nearctic Rhopalocera, 1. Hesperioidea" (*Journ. lepid. soc.* 14: 24-36; 1960) and "2. Papilionoidea" (*ibid.* 15: 209-225; 1962), the later paper including a supplemental note (*ibid.* 15: 225; 1962), it has been decided to change the title of the forthcoming Check List of Nearctic Rhopalocera to *Synonymic List of the Nearctic Rhopalocera,* as that title more exactly describes the nature of the work.

A few communications relative to the synonymy of some Nearctic names have been received, one calling attention to an error in the first paper, and the other leading the author to a re-examination of another question of synonymy.

Urbanus Hübner [1806]. This name was referred to on page 54 of the first paper and considered invalid. But it is the "*Urbanus*" of HUEBNER's *Tentamen* which was rejected by the International Commission on Zoological Nomenclature in Opinion 275. The fact was overlooked by the auther that HUEBNER published validly the same name the following year on several plates of his *Sammlung exotischer Schmetterlinge.* Dr. HEINZ EBERT of Rio Claro, Brazil, has kindly called my attention (*in litt.*) to this error, and it is therefore necessary to sink *Goniurus* Hübner "1816" [1819] as an objective synonym of *Urbanus* Hübner "1806" [1807]. Dr. EBERT's letter arrived in time to make this correction.

Hesperia logan Edwards "1863-4" (1863) and *H. delaware* Edwards "1863-4" (1863). These names were published in the same paper, *H. logan* having page priority. Mr. FRANCIS HEMMING of London, England, has asked my advice concerning which of these names should be used as the type of *Anatrytone* Dyar, 1905. Involved is the applicability of page priority or first reviser rule. Since the latter is now the "law" (*Code,* Article 24) it is necessary to decide the subjective question, who was the first revisor? It appears to have been EDWARDS himself when he published his *Synopsis of North American Butterflies* [1866]-1872 in which he placed *logan* in the synonomy of *delaware.* Consequently *delaware* will be used in the *Synonymic List.* In this connection attention is called to a paper by PADDY MCHENRY (*Bull. Brooklyn ent. soc.* 47: 16; 1952) giving the dates of publication of this paper of EDWARDS.

Lycaeninae. Unfortunately the *Synonymic List* was submitted for publication before the appearance late in 1961 of a revision of Lycaeninae by my colleague, HARRY K. CLENCH, *in* Ehrlich & Ehrlich,

How to know the butterflies. It has not been possible to incorporate much of his extensive revisionary work in the *Synonymic List.*

Euphydryas chalcedona hermosa Wright 1905, and *E. c. klotsi* dos Passos 1938. Mr. DAVID L. BAUER of Bijou, California, has written to me that he believes that an error was made by me in sinking *klotsi* for *hermosa* (*Journ. lepid. soc.* 15: 220; 1962). This opinion is based upon considerable field experience during which time he has bred these insects and observed that they have different larval food plants. Since the genitalia of *hermosa* and *klotsi* are of the *chalcedona* type it may be that these insects, although described from localities not very far apart, are valid subspecies. The solution of the problem requires further study and it is to be hoped that Mr. BAUER will publish his observations. In the meanwhile it is only fair to other lepidopterists to issue this note so that they may be on the alert for further facts.

Washington Corners, Mendham, N. J., U. S. A.

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE – NOTICE OF USE OF PLENARY POWERS

Public notice is hereby given of the possible use by the International Commission on Zoological Nomenclature of its plenary powers in connection with the following case, full details of which will be found in *Bulletin of Zoological Nomenclature,* Vol. 20, Part 5, published on 21 Oct. 1963.

Validation of *Ortholitha* Hübner, [1825] (Insecta, Lepidoptera). Z. N. (S.) 1585.

Any zoologist who wishes to comment on the above case should do so in writing, and in duplicate, as soon as possible, and in any case before 21 April 1964. Each comment should bear the reference number of the case in question. Comments received early enough will be published in the *Bulletin of Zoological Nomenclature.* Those received too late for publication will, if received before 21 April 1964, be brought to the attention of the Commission at the time voting begins.

All communications on the above subject should be addressed to:

The Secretary,
International Commission on Zoological Nomenclature,
c/o British Museum (Natural History),
Cromwell Road,
LONDON, S. W. 7, ENGLAND.

W. E. CHINA
Acting Secretary to the International Commission on Zoological Nomenclature

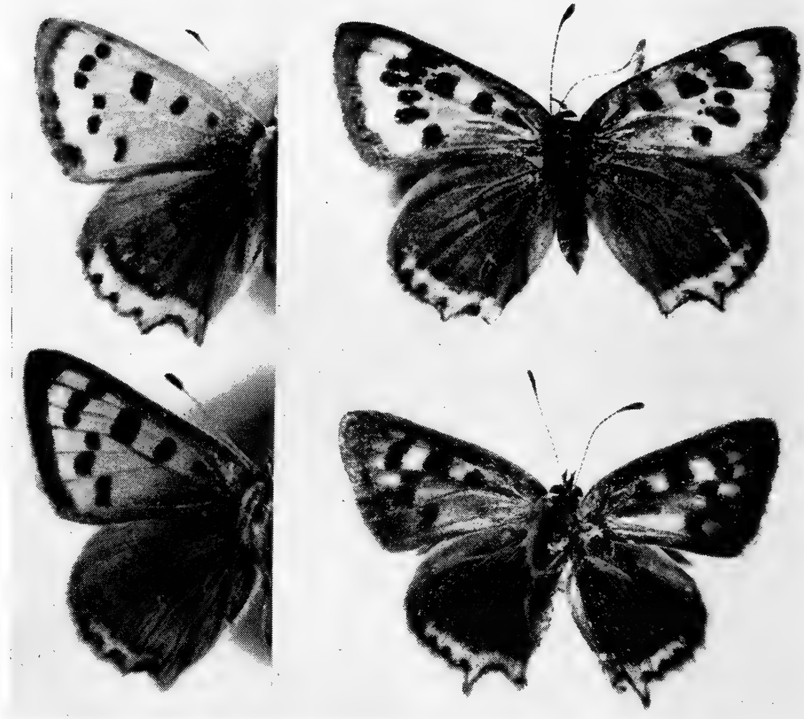
EXPERIMENTALLY INDUCED SEXUAL DIMORPHISM IN *LYCAENA PHLAEAS* (LYCAENIDAE)

by Eric Lees

Lycaena phlaeas L. is widely distributed throughout the Holarctic Region and many subspecies have been recognized and described. In the majority of subspecies the wing coloration and pattern of both male and female butterflies is the same. However, in a few, *e. g., L. p. daimio* from Japan, sexual dimorphism does occur and the forewings of the male have a much darker and less coppery ground coloration than in the female. Many other species of the genus *Lycaena* exhibit a marked sexual dimorphism.

In view of the marked tendency towards sexual dimorphism in the genus *Lycaena* and its exceptional absence in the majority of *L. phlaeas* subspecies, it was decided to subject immature stages of the British subspecies *L. p. phlaeas* to extreme environmental conditions, in order to determine whether or not it is possible to induce differences of color or pattern between the two sexes. To this end larvae and pupae were raised in the laboratory from parents from Ilkley, Yorkshire, at a constant temperature of 35°C, which is considerably higher than the temperature normally experienced by this species in the field. The dates of the experiment were: 10-25 Sept. 1962. The larvae were fed on their normal foodplant Sheep's Sorrel, *Rumex acetosella,* and their development took place very rapidly. Probably because of the high temperature, the mortality rate of the larvae was rather high and only twelve pupae were obtained. These gave rise to ten adult insects, of which six were males and four females. The males were markedly different from the females in both coloration and pattern. Furthermore all these experimentally produced insects differed from the normal wild type, *L. p. phlaeas.* The appearance of the male and female butterflies obtained in these experiments is illustrated in the figure.

The experimental females retain the bright copper color of the forewings characteristic of the wild type insects. The spots nearest the apex of the wing, however, have become elongated in the direction of the veins and are much larger and no longer rounded as in the wild type. In addition there are several smaller patches of black pigment present, which are not present in the wild type. The experimental males are all very dark and the deposition of melanin pigment is much heavier than in the wild type. The ground color of the forewings is a dull brown rather



Right: *Lycaena phlaeas,* forms obtained experimentally; top — female; bottom — male. Left: normal forms: ♀ (above) captured Ilkley, Yorkshire, England, 11 Sept. 1961; ♂ (below) captured Ilkley, Yorkshire, 6 June 1962.

than a bright coppery orange except for a lighter patch in the middle of the wing. The spotting in the male resembles that of the wild-type insect but the spots are less obvious because of the dark background. All these characteristics apply to the upper-surfaces of the wings, the under-surfaces are somewhat darker but not otherwise different from the wild type.

It would appear, therefore, that under certain environmental conditions the genes of *L. p. phlaeas* can give rise to a marked sexual dimorphism. The male phenotype produced in these experiments closely resembles the male wild type of *L. p. daimio*. The experimentally produced females are rather distinct and do not show marked similarity to those of any other subspecies.

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NINE NEW BUTTERFLY RECORDS FOR THE STATE OF MARYLAND

by Robert S. Simmons

A continued study of Maryland butterflies has led to the discovery of new species heretofore unknown from the Maryland area or species that have been previously captured but for some reason orother the data never published. This is Number 3 of Contributions to the Knowledge of Maryland Butterflies.

Dr. William A. Andersen and the author made a field trip to the mountains of western Maryland on June 18, 1955. Near Flintstone in Allegany County we located a colony of *Lethe portlandia anthedon* A. H. Clark along the wooded flood plain of a small tributary of Fifteen Mile Creek. We each took a small series but not without tough, rugged collecting. Haydon ("The Satyridae of Maryland", *Proc. nat. hist. soc. Maryland;* 1934) states that he observed *L. portlandia* once in a woods near Loch Raven in Baltimore County and once in Allegany County near Cumberland. Many collectors have repeatedly worked the Loch Raven area and have failed to find this species. The Natural History Society of Maryland maintained an insect collection that contained a series of eight *Lethe e. eurydice* Johannson from the Loch Raven area all identified and labeled as *L. portlandia.* Whether these were Haydon's specimens or not is unknown. If they were his, then they were definitely misidentified. If they were not his, then there are no existing speciments confirming the records and such sight records are too dubious to be accepted. However, our records from western Maryland definitely establish this species as a Maryland resident.

While comparing notes with Franklin H. Chermock we discovered he had in his fine collection several Maryland specimens of *Speyeria atlantis* Edwards and *Nymphalis milberti* Latreille which represent the first known Maryland records. A few years ago he resided near Frostburg in western Maryland where he collected several local butterflies among which were these two species. The *S. atlantis* were captured on July 1, 1940, in a wet meadow flying with large numbers of *Speyeria cybele* Fabricius and *Speyeria aphrodite* Fabricius. The predominant flowers attracting the insects were milkweed and thistle. Numerous *N. milberti* were flying in a high dry open field of flowering goldenrod on July 7, 1949. Mr. Chermock collected them as they fed on the goldenrod flowers. He kindly gave me one of each species for Maryland studies.

On June 10, 1959, Mr. CHERMOCK took a two-hour field trip to one of our favorite collecting sites just three miles north of Baltimore City. In an alfalfa field overlooking an extensive marsh he netted a fresh male *Adopaea lineola* Ochsenheimer. This capture represents the first Maryland record for this species. The area has been worked repeatedly since the capture, but to date no more have been found.

In going over publications containing Maryland records for Lepidoptera, one notices the absence of published records for *Incisalia irus* Godart, *Strymon cecrops* Fabricius, *Hesperia metea* Scudder, *Panoquina panoquin* Scudder and *Wallengrenia otho otho* J. E. Smith. The author has found three isolated colonies of *I. irus* in Maryland. All three colonies exist in the same type of habitat characterized by dry semi-open second growth situations composed primarily of scrub oak, pine, huckleberry, honey locust, andropogon grass and lupine. *I. irus* has been observed many times ovipositing on lupine flower buds. Lupine is the main foodplant in the three colonies if not the only foodplant. *Baptisia,* which is a known foodplant in New Jersey and other states, does not occur in the colony areas. Although this species is seen every year, having a flight period from the last week in April to the second week of May, it is rare and very local. The known colonies are listed below.

S. *cecrops* is a common insect that has been taken in Maryland by many collectors for a number of years. It is primarily a denizen of the Coastal Plain but does venture into the Piedmont Plateau at times, especially along river valleys. According to my studies the deepest penetration of the Piedmont Plateau was made during the 1948 season when this species traveled north and west seventy-five miles in excess of its normal range. There are usually three broods a year which are April-May, July, and August-September. Some records are listed below.

Although *H. metea* is uncommon and quite local it has been collected annually by several Maryland collectors. This species is tricky to locate but once a colony is discovered, specimens can usually be found there every year. In most areas where colonies exist only a few butterflies are seen each season. However, there are colonies consisting of large numbers where on the proper day and with effort a series can be taken. It has been my experience that unless this butterfly is engaged in feeding it is extremely shy, hard to approach and difficult to capture. In Maryland they prefer xeric situations that are open or semi-open with pine and *Andropogon* grass. The flight period usually runs from the last week of April to the third week of May. A few records are listed below.

The Salt Marsh Skipper, *P. panoquin,* is locally and seasonally variable and at times common. This is a species of the tidal marshes but may be lured to flowers a mile or more away. Although unreported from Mary-

land this species has been found in every county along the coast including many countries with tidal marshes bordering the Chesapeake Bay.

The literature contains records for *Wallengrenia otho egeremet* Scudder but there are no published records of *W. o. otho*. Many good collectors never found it here. AUSTIN H. CLARK reported ("The Butterflies of Virginia", *Smithsonian misc. coll.* 116, no.7: p.167) the sudden appearance of this species in Virginia around the year 1940 when, according to him, it became common while previously it was absent. It was about the same period that it also seemed to appear in Maryland, limited to the coastal plain. It is still found there rather commonly especially around the tidal marshes and environs. Whether this butterfly extended its range or not remains a mystery, sinceit is possible the species was always there; but due to the annual variability of local occurence plus extremes in numerical fluctuations a situation could exist where good collectors might easily overlook it. A few records are listed below.

Briefly summarized, the Maryland records are as follows:

1. *Lethe portlandia*: VI-18-55, near Flintstone, Allegany Co.
2. *Speyeria atlantis*: VII-1-40, U.S. Route 219 & Chestnut Ridge, Garrett Co.
3. *Nymphalis milberti*: VII-7-49; Frostburg, Allegany Co.
4. *Incisalia irus*: IV-30-55, near Fort George G. Meade, Prince George's Co.; V-5-56, Gambrills, Anne Arundel Co.; V-8-60, near Glen Burnie, Anne Arundel Co.
5. *Strymon cecrops*: VIII-19-48, Northwood, Baltimore City; VIII-21-52, North Chesapeake City, Cecil Co.; IV-29-54, Severna Park, Anne Arundel Co.
6. *Hesperia metea*: V-13-53, Bare Hills, Baltimore Co.; IV-29-54, Severna Park, Anne Arundel Co.; IV-28-56, Flintstone, Allegany Co.
7. *Panoquina panoquin*: VII-25-49, Chesapeake Beach, Calvert Co.; VI-21-57, Ocean City, Worcester Co.; VIII-11-50, Kent Is., Queen Anne's Co.
8. *Wallengrenia o. otho*: VIII-18-51, Chesapeake Beach, Calvert Co; VI-19-56, Woolford, Dorchester Co.; VIII-11-60, Budds Creek, St. Mary's Co.

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MIGRATION OF *HASORA CHROMUS* (HESPERIIDAE) IN GUJARAT STATE, INDIA

On July 24, 1960 I saw a northwest movement of large skippers at Ahwa, government headquarters of the Dangs District, Gujarat State. This movement of skippers was first noticed at 5:15 p.m. on Sunday. A great majority of the skippers were flying at an estimated height of twenty-five to thirty feet. They were clearing the top of a mango tree (*Mangifera indica*) near our chicken house in the mission compound and the top of the Gul Mohur tree (*Delonix ragia*) some thirty yards away. A few skippers were flying at an altitude of over fifty feet. Even though the monsoon rains had started, the evening sky was clear for this mass movement of butterflies.

After finding a ladder and a net, I climbed up on the roof of the chicken house. Still most of the skippers were either out of reach or I failed to catch them as they sped past. Repeated counts showed that from twelve to fifteen skippers were passing overhead every minute. The migrating numbers greatly decreased after sunset. In one hour approximately 700 to 900 skippers passed by my observation point. They all appeared to be of one species. At dusk a few skippers were seen flying low over the ground, so I rapidly descended the ladder and started to swing at these fast-flying targets. Finally one was netted and it proved to be the Common Banded Awl, *Hasora chromus*.

Hasora chromus (Cramer) is a very common butterfly in India, being found on the plains and up to at least 7,000 ft. in the hills. It flies in bright sunshine, at dusk, and occasionally around lights at night.

No further migration of this species was observed; however, on July 29th I discovered over 500 resting on a bush in a village about five miles west of the first observation point. Apparently these skippers were assembling for some mass movement or had been migrating.

Ernest M. Shull, Ahwa, via Bilimora, Dangs Dist., Gujarat, INDIA

ESPECIALLY FOR FIELD COLLECTORS

(Under the supervision of FRED T. THORNE, 1360 Merritt Dr., El Cajon, Calif., U.S.A.)

A TRIP INTO CALIFORNIA AND OREGON FOR *SPEYERIA*

by OAKLEY SHIELDS

The *Speyeria*-rich states of California and Oregon can provide many an enjoyable day's collecting for those seeking the argynnids, as we soon discovered. For forty days in the summer of 1961 DAVID DIRKS and I visited many productive localities in this territory and returned to home base (La Mesa, California) with collecting boxes bulging. Not only the *Speyeria* but also other butterflies, including skippers, made exciting collecting. Now that L. PAUL GREY has determined and commented on the *Speyeria* taken, and now that the rest of the catch has also been properly evaluated, I feel that the trip is one worth describing.

From June 20 to July 8 (18 days) we stayed on California soil. We drove right on by the Tehachapi and Greenhorn Kern County ranges which we believed too burned up from the dryness. However, we later heard from NOEL LA DUE that he braved a scorcher on June 24 and took nets full of mostly-unsilvered *Speyeria callippe laurina* in the Greenhorns and plucked the choicest ones from flowers by forceps.

Our first stop was from June 21 to 23 at Jerseydale, a valley surrounded by a handsome pine-oak forest at about 3,500 feet elevation near Mariposa in Mariposa County. We did not have to search for profitable spots here because I had already located some after many summers' collecting. There *Callophrys nelsoni* were everywhere on the Bear-clover blossoms and always near Incense Cedars, numerous male *Habrodais grunus* were flushed from thickets along a stream, and *Satyrium californica* were on most every Yarrow. Other familiar species of the region, such as *Speyeria zerene* and *S. hydaspe,* were downright scarce. The *Ceanothus* blooms, usually teeming with *Satyrium saepium* and some *S. auretorum* and *S. adenostomatis,* yielded only a very few *saepium.* Dried-up lupines attracted only some battered *Plebejus icarioides.* The area supposedly received 30% to 40% of its normal rainfall. We did round up a handful of *Erynnis propertius* and several *E. persius,* determined by JOHN M. BURNS. Some *Cercyonis sthenele* and several *Pieris napi castoria* were flying. We found *S. callippe inornata,* chiefly unsilvered with disks pale brown to dark brown, in a minor flight on the mints and under the Ponderosa Pines near Jerseydale on June 24. We stayed just enough to get a case of Poison Oak chasing *H. grunus.*

I have often collected in the Tioga Pass area (above 10,000 feet) of Yosemite National Park, but never as early as June 25. Most of the season's snows here had fallen during April and May, so that we expected the pass to be still under snow. But an early warm-weather thaw had brought out a small wealth of specimens that morning before it became overcast. For a time *Philotes battoides* thronged to Sulphur-flowers on the ridge saddle at 11,000 feet, where some fresh male *Oeneis chryxus ivallda* patrolled the rock outcroppings. *Lycaena cupreus* flashed over the bare slopes in the same places we scoured for the green *Callophrys lemberti,* lately named by J. W. TILDEN. We managed to catch two pairs of *Papilio indra* after some furious net-swishing. The season at Tioga Pass was indeed progressing rapidly, for *Pieris sisymbrii* were already ragged and two fresh *Chlosyne damoetas malcolmi* were seen flying. STERLING MATTOON later told me that by July 9 the *P. battoides* were still riding the saddle; however, by then he was too late for much else except *Euphydryas editha nubigena.* Though MATTOON found no *Colias behrii* then, three weeks later he ran into numerous *behrii* there.

We worked at Lee Vining and Mono Lake in Mono County on June 26th and 27th. Though we could find a few *Coenonympha tullia mono* in most of the meadows checked, a particular lush, grass-iris meadow west of Lee Vining produced great numbers of a fresh hatch. Momentarily we mistook the *mono* for a *Colias eurytheme* cloud. Along the west shore of Mono Lake, *Hesperia harpalus* (determined by C. DON MACNEILL) and *Phyciodes campestris* were in moderate flights along with a few of the very localized *E. editha monoensis,* and at mud were male *Plebejus icarioides ardea* and *Philotes battoides glaucon.* Typical *Limenitis weidemeyerii nevadae* and the *L. w. nevadae* × *lorquini* hybrid (*fridayi*) were scarce but worth all the slogging under the willows necessary to snag them. *O. chryxus stanislaus,* like the Tioga Pass *ivallda,* were just emerging the next day at Sonora Pass in Stanislaus County; however, strong winds made netting them nearly impossible. Later (July 8), MATTOON bagged a terrific series of *stanislaus* there.

On June 29 we briefly visited the Lake Tahoe region. A morning's footwork along the ridge at Echo Lake rewarded us with a fair series of *Euphydryas chalcedona sierra,* nearly all fresh males. *Erynnis propertius* and *E. lilius,* determined by Dr. BURNS, flew in the scrub and were difficult to collect. That afternoon near Fallen Leaf Lake *Pyrgus communis* and *Phyciodes campestris montana* were thick in the meadows, but we worked on the *Chlosyne palla whitneyi* in the forest.

Entering Sierra County on June 30, we collected along the road through Sattley, Yuba Pass, Sierra City, and Downieville. We picked up small numbers of *Speyeria hydaspe, S. zerene, S. coronis,* and *S. egleis,* but the real prizes were a few *S. callippe* (near *juba* and *sierra*) that came to

the mints and Pussy Paws. *E. propertius* and *E. lilius* were fairly plentiful. Near Downieville flew some *Parnassius clodius sol,* markedly larger than the high-Sierran *baldur* I am familiar with. The collecting at Gold Lake in Sierra County was very poor on July 1, so we drove down the grade to Graeagle, picking off a few *S. zerene, S. coronis,* and *S. hydaspe* as we went. We inspected a bed of sunflowers in a wood at Quincy in Plumas County late that afternoon and swept up small series of *S. zerene, S. hydaspe, S. cybele leto,* and *S. coronis.* We also netted some *S. callippe* (near *juba*), mostly silvered with yellowish undersides. These *callippe* sometimes closely paralleled the brown-disk *coronis* on undersurfaces, one specimen being a real coin-flipper. Surprisingly, the *callippe* sexes flew quite apart from each other. I went one way and took mostly ♀♀, while DAVE went another and got ♂ *callippe.* A few *Cercyonis boopis incana* and *Coenonympha tullia ampelos* were flying here.

We worked along a road to Silver Lake from Westwood in Lassen County on July 2nd and 3rd. The mints beneath the Ponderosa Pines were loaded with *Speyeria.* Roughly three-fifths of these were *egleis* (near *oweni*), the rest being *zerene conchyliatus* and occasionally a *coronis.* The variable *egleis* were at or near their peak, and the *zerene,* chiefly males, were just appearing. This was our first big *Speyeria* catch of the trip, but by no means proved to be the last. With the *Speyeria* were a few worn *E. editha,* which S. G. JEWETT called close to *aurilacus.*

On the 4th of July we caught a few *S. hydaspe* and *S. zerene conchyliatus* near Viola in Shasta County, on the way to the Mt. Shasta region. The next day we collected near Bartle in Siskiyou County in hopes of netting some of the weird *S. callippe* blends there. Despite all the large mint beds, we found no *callippe* but did bag 20 fresh ♂ *S. atlantis* (near *dodgei*) from a wood. Dark *Limenitis lorquini* were plentiful, and we took many variable *E. chalcedona dwinelli* from a clearing. Dr. MACNEILL tentatively identified a *Polites* from here as *themistocles turneri,* pending genitalia check; probably a new California record.

Along the road to Castle Lake in Siskiyou County on July 6 and 7, we gathered a generous supply of *S. zerene conchyliatus* and *S. hydaspe purpurascens* which were filling up on mint and milkweed nectar. *Hesperia harpalus oregonia* (determined by MACNEILL) were also common on the milkweed. *Chlosyne palla* were fairly numerous, and a few beat-up *S. callippe rupestris* showed they were the tag ends of an earlier flight. Several *Philotes* from here TILDEN called *battoides intermedia.* Also, some *C. boopis incana* were flying beneath the trees.

We crossed into Oregon on July 8 and spent the day on the slopes of Mt. Ashland in Jackson County. At the lower elevations were some *Chlosyne leanira,* mostly females, and an occasional *Cercyonis boopis.*

Plebejus argyrognomon anna came to wet places in the meadows. On Mt. Ashland, areas of *Speyeria* concentration could plainly be determined. Faithful *hydaspe* and *zerene* were on mints on the well-forested slopes, although a given mint patch was likely to yield exclusively *zerene* or exclusively *hydaspe*. But the few *egleis* (near *oweni*) and *callippe elaine* were confined to the Pussy Paws higher up on the peak's exposed shoulder, in cahoots with *Philotes battoides oregonensis* (TILDEN determination). Mr. GREY says his records suggest that *Speyeria* behave this way in many places. He thinks that *Speyeria* species forming rough "layers" on a mountainside like this indicate ecologic banding and thus possible breeding-ground differences between the species. We were later to see this ecologic banding of *Speyeria* again in the Ochoco Mountains.

We tried the road along Illinois River Valley in Josephine County on July 9 and 10. This is the type locality for MOECK's *S. zerene gloriosa,* supposedly dead center in appearance and geography between *zerene zerene* and *zerene bremneri.* The *gloriosa* were fairly common on mints, at water seeps, and on the wing, though difficult to net on the steep slopes. Most were fresh males, with a few *S. hydaspe* and several *S. coronis* among them. As in the Bartle locality, the extensive mint beds were surprisingly lacking of butterflies. *C. boopis* and *C. sthenele* were sympatric here. Some dark, worn *E. chalcedona* Dr. JEWETT found closest to *chalcedona* by genitalia but indistinguishable from *colon* in pattern.

We drove to O'Brien in Josephine County on the afternoon of July 10th, where several *S. coronis,* a few *S. hydaspe,* and many *S. zerene gloriosa* came to a thistle patch. The *gloriosa* here averaged slightly larger and lighter than Illinois River Valley specimens. They also had an apparently earlier hatch, since fresh and flown males were together in equal numbers. The undersurfaces of the *coronis* closely paralleled those of *gloriosa.* Again, we found *C. boopis* and *C. sthenele* flying together. On July 11 at Butte Falls in Jackson County, the type locality for *S. callippe elaine,* we took a few of the ever-present *S. hydaspe* but only a worn *elaine.*

We collected between thunderstorms on Mt. Thielson in Douglas County on July 12. High on the slopes we found the little *E. editha lawrencei* fresh and netted a fair series. Also a few *Plebejus acmon lupini* and a single green *Callophrys lemberti* were flying.

The next day we dropped down east of the Cascades to a wide, pine valley that stretches to the Walker Rim Plateau. Here we drove along dusty logging roads east of Beaver Marsh in Klamath County. We met with many *Cercyonis oetus* on the sage-pine flats. Some lupine attracted a few male *Plebejus shasta,* and some *E. editha remingtoni* (JEWETT determination) at mud were an unexpected prize. *P. campestris* were fairly plentiful on the milkweeds. The smallish *S. zerene* and the red,

dwarfed S. *egleis,* which came to blue pentstemons, were our first taste of the "east slope Cascade" *Speyeria.* Both were highly variable. We also caught some *Satyrium behrii,* which is evidently a good Oregon record.

The Crescent area in Klamath County showed no obvious difference in terrain or vegetation from the Beaver Marsh area. Near Crescent on July 15 we again discovered many *C. oetus,* and the *S. behrii* were fairly numerous. We also took a short series of *H. harpalus oregonia* (MacNeill determination), *C. palla,* and *P. shasta.* But the big catch was many more of the dwarfed, variable *S. eglieis* and *S. zerene* that came to the blue pentstemons. *S. egleis* had been out for a while, but only the freshest male *zerene* appeared. (See the reference by Tilden to the Sand Creek area *Speyeria,* of which these Klamath County *Speyeria* are a part.) *S. egleis* and *zerene* seemed to be a happy combination in the Ponderosa Pine flats here, at Beaver Marsh, and at Westwood.

We met with a terrific flight of *Speyeria* between Paulina Lake and East Lake in Deschutes County from July 16 to 18. The pentstemons among the Lodgepole Pines attracted the *callippe semivirida* literally by the thousands. Most were fresh females, with the males on the decline; the sex ratio was lopsided, with about one male to every seven females. We took nearly 800 *callippe* before calling it quits, and they still covered the pentstemons when we left. The name *semivirida* is used here as a catchall for some remarkable variation: from pale greens to dark browns, and from wide, pale bands to solid suffusion. Yet none ever approached the red-brown of our Mt. Ashland *elaine.* We were surprised to learn that Jewett, Moeck, and Ray Albright had previously found the Paulina area to be poor collecting. Among the myriads of *callippe* were some worn *S. coronis* and a few of the red-dwarf *S. egleis* and *S. zerene.* This small catch of *zerene* turned out to be quite important. Most of the twenty-five were the typical "east slope Cascade" reds except for three of the brown *picta*-type of *zerene.* Thus we had located a blend zone between two distinct clines of *zerene,* namely the *garrettii* browns (including *picta,* the reddish-disk extremes) from the Ochoco and Maury ranges and the *zerene* reds of the "east slope Cascade" country. (See the recent discussion by Grey and Moeck in this journal on a similar subspecies clash between *cynna* and *zerene.*) Grey had long suspected that these two clines would meet in that vicinity.

From July 19 to 22 we collected in Canyon Creek Canyon in the Ochoco Mountains, a range well-known for its great numbers of *Speyeria.* Many *C. boopis* were flying, along with an occasional *C. oetus.* After much chasing we captured some *Colias alexandra edwardsii* and *C. occidentalis;* most of the female *occidentalis* were albinic, but only one of the female *edwardsii* was albinic. The *Speyeria* in this canyon, as on Mt. Ashland, exhibited ecologic banding. *S. hydaspe,* the predominant

butterfly, was distributed throughout the canyon on the mint beds in the forest meadows. A few female *coronis* were scattered among the *hydaspe.* Some *callippe semivirida* were in the canyon's lower portions on the mints. The large flight of *zerene* (near *picta*) was in the canyon's upper parts; they were often with *hydaspe* at the mints but were off on their own mint patch at times. Numerous *cybele leto* flew at mid-canyon and lower canyon levels to the thistles. The *atlantis dodgei,* which sometimes closely paralleled the *hydaspe* on the undersurfaces, flew with *hydaspe* at the upper canyon levels but were scarce. S. *mormonia* (near *erinna*) were just emerging and came to asters in the higher meadows. And finally, the few *egleis* sought the highest parts of the canyon. Again, *zerene* proved to be the important catch. Among the *picta* browns were a few of the "east slope Cascade" red *zerene,* indicating gene exchange, with the Paulina material at the other end of this blend zone. The difference was quite striking between the large, brown-green *egleis* and the "east slope Cascade" red-dwarf *egleis* we had just left. Sometimes our field boxes became so full, we had to pause to empty them.

During a pleasant, restful stay with RAY ALBRIGHT we netted, on July 24, some S. *cybele pugetensis* along a forest road north of Willamina in Yamhill County. These were considerably darker than Ochoco *leto.* On July 25 Mr. ALBRIGHT drove us to some of his collecting spots near Mt. Hood. We took a small catch of S. *coronis* and S. *zerene* (near *picta*) on thistles and mints in the forest along the Mt. Wilson Lookout Road in Wasco County. The brown *coronis* and *zerene* paralleled each other on the undersides, making identifications difficult. Again with Mr. ALBRIGHT July 26 we tried for S. *zerene hippolyta* at several localities along the Oregon coast but took only several *P. napi castoria.*

We started homeward in July 27. Returning to Crescent, we found the pentstemons dried up, and the small catch of S. *zerene* and S. *egleis* was worn. We briefly visited Sand Creek in Klamath County on July 28. Some of the usual dwarf S. *egleis* and S. *zerene* were landing on a yellow-flowering bush in the pine clearings. From Sand Creek we drove home. We were quite satisfied with the 6,000-specimen catch, two-thirds of which was *Speyeria.* This certainly was far more material both in quantity and importance than we had anticipated collecting.

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BIOGRAPHICAL REMINISCENCES OF McDUNNOUGH, BARNES, AND DAVIDSON

Publication of the biography of Dr. J. H. McDunnough (Ferguson, *Journ. lep. soc.* 16: 209-228; 1963) and the obituary notice relative to W. M. Davidson (Rawson, *Journ. lepid. soc.* 16: 250; 1963) in the *Journal* prompts me to write a few personal reminiscences.

When I was at Stanford University I spent my summers working at resorts at Lake Tahoe. This had the two-fold advantage of allowing me to collect butterflies in my spare time and also earn some money. I had sent Dr. William Barnes some butterflies from Tahoe as well as a brochure of Deer Park Inn, where I worked, and which was situated in the next small valley south of the now famous Squaw Valley. The upshot of this was that the doctor, his wife, son and daughter, and Dr. McDunnough, came to Deer Park for a couple of weeks in the summer of 1910. (The Brief Biography of Barnes, in the *Lepidopterists' News* 3: 53-54; 1949, says he went to the Tahoe region in 1917, and this may have been another trip.) My chief recollection of this family was seeing them start out in the morning, each one armed with a net, which created something of a stir, as most of the resort guests could not quite understand this type of activity. That was the year when Jack Johnson knocked out Jim Jeffries at Reno on July 4 in what was then called a prize fight. The good doctor and his son forsook the net for the time being and went down to Reno to see the fight. I do not recall whether McDunnough went along.

W. H. Davidson and I were at Stanford together; he graduated a year ahead of me. Dave, as we called him, had the reputation among the entomology students of bringing in from field trips more rare and odd insects than the rest of us together. And from that I would say he was very observant. Incidentally, he belonged to the Stanford Chess Club and was on the college team for three years. The note about him in the *Journal* says he was in the "U. S. Food Distributing Administration." Lest the conclusion be drawn that he became a distributor of food, let it be known that there was no such administration. Actually, Dave was with the U. S. Food & Drug Administration. Earlier he was with the Insecticide and Fungicide Board, which had the job of testing new insecticides and fungicides to see if they would be effective and safe to use. In 1927 this Board became a part of the reorganized Food, Drug and Insecticide Administration, the name of which was later changed to Food and Drug Administration.

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RECENT LITERATURE ON LEPIDOPTERA

Under this heading are included abstracts of papers and books of interest to lepidopterists. The world's literature is searched systematically, and it is intended that every work on Lepidoptera published after 1946 will be noticed here; omissions of papers more than 3 or 4 years old should be called to Dr. BELLINGER's attention. New genera and higher categories are shown in CAPITALS, new species and subspecies are noted, with type localities if given in print.

F. BIOLOGY AND IMMATURE STAGES

Mills, M. B., "Observations on the life history of the moth *Anthela xantharca* (Meyrick)." *West. Austral. Nat.*, vol.4: pp.86-90, 4 figs. 1954. Larvæ of *A. xantharca* (Anthelidæ) feed during the winter at night on *Acacia acuminata;* the adults emerge the following autumn. [I. C.]

Minamikawa, Jinhaku, "On the hymenopterous parasites of the tea-leaf rollers found in Japan and Formosa." *Mushi,* vol.26: pp.35-46, 3 figs. 1954. Records of 19 spp. parasitic in *Homona coffearia, Adoxophyes privatana,* & *Gracilaria theivora;* 3 parasites are described as new. [P. B.]

Minch, Edith L., "Insect inhabitants of *Polyporus betulinus.*" *Journ. New York ent. Soc.,* vol.60: pp.31-35. 1952. Including larva of *Tinea granella.* [P. B.]

Minkiewicz, St., "The Codling Moth *Carpocapsa pomonella* (*Cydia* Wlshm., *Laspeyresia* Meyr.). Morphology, development and biology" [in Polish; English summary]. *Bull. ent. Pologne,* vol.19: pp.23-91, 7 pls. 1949.

Mitchell, Robert T., "Consumption of Spruce Budworms by birds in a Maine spruce-fir forest." *Journ. Forestry,* vol.50: pp.387-389. 1952. Lists 40 spp. whose stomachs contained *Choristoneura fumiferana;* estimates amount of predation by 14 spp. [P. B.]

Mitiaev, I. D., "Data on the biology of *Bucculatrix ulmiella* Ger." [in Russian]. *Trudy Inst. Zool. Kazakhskoi SSR,* vol.4: pp.218-222. 1955. [Not seen].

Moingenon, M., "Quelques remarques sur *P. podalirius* L." [in French]. *Bull. Soc. ent. Mulhouse,* 1947: pp.19-20. Foodplant of first generation of this *Papilio* is *Prunus mahaleb.* Notes on biology. [P. B.]

Momoi, Sigeyuki, "Notes on the breeding of *Papilio helenus* at Yokohama (Papilionidæ)" [in Japanese]. *Collecting & Breeding,* vol.13: pp.284-288, 2 pls., 4 tables. 1951. Foodplants: *Citrus* spp. [T. I.]

Morgan, Councilman, G. H. Bergold, Dan H. Moore, & Harry M. Rose, "The macromolecular paracrystalline lattice of insect viral polyhedral bodies demonstrated in ultrathin sections examined in the electron microscope." *Journ. biophys. biochem. Cytol.,* vol.1: pp.187-190, 3 pls. 1955. Parasites of *Lymantria dispar* & *Bombyx mori.*

Morgan, Councilman, G. H. Bergold, & Harry M. Rose, "Use of serial sections to delineate the structure of *Porthetria dispar* virus in the electron microscope." *Journ. biophys. biochem. Cytol.,* vol.2: pp.23-28, 3 pls. 1956.

Morley, A. M., "*Catocala fraxini* L.—a further note." *Ent. Gaz.,* vol.1: pp.99-100. 1950. Rearing.

Morley, A. M., & G. H. Youden, "The first appearance of *Thalera fimbrialis* Scop. (Lep: Geometridæ) in Kent." *Ent. Gaz.,* vol.3: pp.193-195. 1952. Account of unsuccessful rearing, on Wild Thyme; describes larva. [P. B.]

Moucha, Josef, "Quelques remarques sur *Gastropacha populifolia* Esp. et *Gastropacha quercifolia* O." [in French]. *Bull. Soc. ent. Mulhouse,* 1951: pp.37-28, 1 fig. 1951. The biology of *G. populifolia* is described and a case of a monstrosity of the wing of *G. quercifolia* is recorded & figured. [J. M.]

Moucha, Josef, "The importance of asilid-flies in the nature" [in Czech; Russian & English summaries]. *Acta Rer. nat. Distr. Ostraviensis*, vol.13: pp.549-553, 4 figs. 1953. *Pieris rapæ* as prey of *Laphria fimbriata*, and *Lycæna phlæas* as prey of *Machimus atricapillus*. [J. M.]

Moucha, Josef, "Über den Einfluss der Nahrung auf die Entwicklung des Schwammspinners (*Lymantria dispar* L.)" [in Czech; German & Russian summaries]. *Acta Soc. ent. Čechoslov.*, vol.54: pp.73-80. 1957. About the breeding of *L. dispar* caterpillars on different plants. [J. M.]

Müller, Oskar, "Biologische Studien über den frühen Kastanienwickler *Pammene juliana* (Stephens) (Lep. Tortricidæ) und seine wirtschaftliche Bedeutung für den Kanton Tessin" [in German; English summary]. *Zeitschr. angew. Ent.*, vol.41: pp.73-111. 1957. Biology & control; detailed description of all stages, with comparative notes on *Laspeyresia splendana*. [P. B.]

Müller, Peter, "Untersuchungen über die Morphologie und Biologie der Raupenfliege *Drino lota* Meigen" [in German]. *Mitt. zool. Mus. Berlin*, vol.32: pp.3-58. 1956. Parasite of *Chærocampa elpenor, Metopsilus porcellus,* & *Bupalus piniarius*. [P. B.]

Müller-Kögler, E., "Über eine Erkrankung der Kiefernspanner-Altraupen und -Vorpuppen" [in German]. *Zeitschr. Pflanzenkrankh.*, vol.58: pp.404-410. 1951. Describes a new bacterial disease of *Bupalus piniarius*. [P. B.]

Mukerji, D., & Basanta Kumar Behura, "On the biology of *Danaus chrysippus* (Linnæus)." *Proc. 33rd Indian Sci. Congr.*: p.123. 1947. Abstract.

Mukerji, Durgadas, & Basanta Kumar Behura, "The enemies of *Danaus chrysippus* (Linnæus)." *Journ. Bombay nat. Hist. Soc.*, vol.47: pp.177-178. 1947. Records of parasites. [P. B.]

Murray, Desmond, "A note on *Odezia atrata* L." *Ent. Rec. & Journ. Var.*, vol.67: pp.188-192, 1 pl. 1955. Describes all stages; foodplant *Conopodium majus*. [P. B.]

Murray, Desmond P., "Some notes on *Philereme vetulata* Schiff." *Ent. Rec. & Journ. Var.*, vol.68: pp.181-182. 1 pl. 1956. Describes all stages; larvæ on buckthorn. [P. B.]

Murray, D. P., "The life history of *Alucita galactodactyla* Hübn." *Ent. Rec. & Journ. Var.*, vol.69: pp.231-232, 1 pl. 1957. Describes & figures all stages; foodplant *Arctia lappa*. [P. B.]

Murray, Desmond P., "The life history of *Nymphula stagnata* Donovan." *Ent. Rec. & Journ. Var.*, vol.69: pp.29-30, 7 figs. 1957. Brief descriptions of all stages. Foodplants *Potamogeton natans* and other water plants. [P.B.]

Muspratt, Vera M., "A new ready-made moth trap" [in English & German]. *Ent. Nachrichtenbl.*, Burgdorf, vol.3: pp.81-82. 1949. Gives short list of moths, mostly Noctuidæ (& *Tineola bisselliella!*), visiting flowers of *Gentiana lutea* by day in Pyrenees; records larva of *Axylia exoleta* feeding on seed capsules. [P. B.]

Nagayama, Fumiaki, "Symbiosis of *Niphanda fusca* larvæ (Lycænidæ) with *Camponotus* ants" [in Japanese]. *Shin Konchu*, vol.3, no.5: pp.18-21, 6 figs. 1950.

Nagayama, H. [F.], "Observations on some Lycænidæ" [in Japanese]. *Insect Ecology*, vol.3: p.98. 1951. Some larval habits of *Celastrina argiolus ladonides, Curetis acuta paracuta,* & *Rapala arata* are observed. [T. I.]

Nagayama, Humiaki [Fumiaki], "Life-history of *Niphanda fusca* Bremer et Grey (Lycænidæ)" [in Japanese; English summary]. *Insect Ecology*, vol.3: pp.3-18, 10 figs. 1950. Original description of the life of this remarkable ant-friend lycænid. Larva is orally fed by ant *Camponotus herculeanus japonicus* by the latter's disgorging of liquid foods. Young larva feeds on the excretion of Oak Aphis, *Greenidea kuwanai*. [T. I.]

Nagayama, Fumiaki, "Eggs of 6 argynnids (Nymphalidæ)" [in Japanese]. *Chukai Sokuro*, no.25: p.2, 6 figs. 1952. *A. anadyomene. cydippe pallescens, sagana, paphia paphioides, laodice japonica,* & *ruslana*. [T. I.]

Nakamura, Masanao, "Biological notes on *Zizeeria maha* (Lycænidæ)" [in Japanese]. *Insect Ecology*, vol.2: p.27. 1948.

Nakamura, Masanao, "Morphological and biological notes on a fungivorous hypenid moth, *Diomea cremata* (Butler) in Japan (Phalænidæ)" [in Japanese; English summary]. *Insect Ecology,* vol.3: pp.37-42, 1 pl., 4 figs. 1950. Foodplants: *Polystictus cinnabarinus* & *P. abietinus.* [T. I.]

Nakamura, Masanao, "A food-plant of *Schiffermülleria heptalitha* Meyrick (Œcophoridæ)." *Insect Ecology,* vol.4, no.4, no.11: p.89. 1952. Fungivorous on *Merulius lacrymas.* [T. I.]

Nakamura, Masanao, "Notes on the 'swell inch-worm on *Ilex crenata* Thunb.' which was recorded by Dr. T. Sasaki (1899)" [in Japanese; English summary]. *Butt. & Moths* (*Trans. lep. Soc. Japan*), vol.3: pp.11-12, 3 figs. 1953. Indentifies larva as *Rhynchobapta flaviceps;* describes pupa. [P. B.]

Nakamura, Shingo, "Notes on the breeding of *Nymphalis xanthomelas japonica* Stichel (Nymphalidæ)" [in Japanese]. *Collecting* & *Breeding,* vol.13: pp.328-330, 2 figs. 1951. Foodplants: *Salix* spp. [T. I.]

Nakatake, Masachika, "Life history of *Papilio memnon thunbergii* (Papilionidæ)" [in Japanese]. *Shin Konchu,* vol.5, no.6: pp.14-18, 15 figs., 1 table. 1952. Foodplants: *Citrus* spp. [T. I.]

Namba, Ryoji, "Descriptions of the immature stages and notes on the biology of *Ithome concolorella* (Chambers) (Lepidoptera: Cosmopterygidæ), a pest of kiawe in the Hawaiian Islands." *Proc. Hawaiian ent. Soc.,* vol.16: pp.95-100, 7 figs. July 1956. Feeds on flowers of *Prosopis chilensis* & *Acacia farnesiana.* Descriptions include larval setal pattern. [P. B.]

Narayanan, E. S., & T. V. Venkatraman, "Technique of mass multiplication of *Stenobracon deesæ* (Cam.) Hymenoptera: Braconidæ for use against sugarcane and maize borers." *Proc. Indian Acad. Sci., Sect. B,* vol.36: pp.12-18, 1 pl., 6 figs. 1952. Reared on *Corcyra cephalonica,* whose eggs are also used, to raise *Trichogramma.* [P. B.]

Narayanan, E. S., & M. J. Chacko, "Superparasitism in *Trichogramma evanescens minutum* Riley (Hymenoptera: Trichogrammatidæ), an egg parasite of sugarcane and maize borers in India. I. Effects of superparasitism." *Proc. Indian Acad. Sci. B.,* vol.45: pp.122-128. 1957. Parasites will oviposit repeatedly in single egg, though only 1 healthy wasp can develop in each egg. Tests on eggs of *Corcyra cephalonica.* [P. B.]

Narayanan, E. S., & B. R. Subba Rao, "Studies in insect parasitism I-III. The effect of different hosts on the physiology, on the development and behaviour and on the sex-ratio of *Microbracon gelechiæ* Ashmead (Hymenoptera: Braconidæ)." *Beitr. Ent.,* vol.5: pp.36-60, 6 figs. 1955. Experiments using 9 spp. of Lepidoptera as hosts. [P. B.]

Narayanan, E. S., B. R. Subba Rao, & M. Ramachandra Rao, "*Hymenia recurvalis* F. and its parasite complex." *Proc. Indian Acad. Sci.,* vol.26: pp.241-246. 1957. Records 3 primary parasites, who effectiveness is reduced by attacks of 8 hyperparasites. [P. B.]

Neunzig, H. H., & George G. Gyrisco, "Some insects injurious to Birdsfoot Trefoil in New York." *Journ. econ. Ent.,* vol.48: pp.447-450. 1955. *Archips rosaceana, Sparganothis sulphurana, Tortrix pallorana, T. velutinana, Plathypena scabra* recorded feeding on *Lotus corniculatus.* Lists 3 parasites of *A. rosaceana.* [P. B.]

Newman, L. Hugh, "Rearing *Nymphalis antiopa* in captivity." *Entomologist,* vol.90: pp.106-108. 1957. Unsuccessful attempts, using sallow as foodplant. [P. B.]

Niimura, Taro, "Biological notes on butterflies (1), (2)" [in Japanese]. *Collecting* & *Breeding,* vol.9: pp.80-83, figs., 1947; vol.10: pp.370-373, 7 figs., 1948. Chiefly larval feeding habits. [T. I.]

Niimura, Taro, "*Hyphantria cunea,* a new pest from America (Arctiidæ)" [in Japanese]. *Shin Konchu,* vol.2, no.9: pp.16-17, 4 pls.; vol.4, nos.2/3: pp:28-29. 1949, 1951.

Nininger, Harvey, "The mystery of the little brown jugs." *Natural History,* vol.65: pp.374-377, 7 figs. 1956. Metamorphosis of *Phlegethontius.*

Nishida, Toshiyuki, "The phenomenon of arrested insect development in the Hawaiian Islands." *Proc. Hawaiian ent. Soc.*, vol.15: pp.575-582. 1955. *Depressaria umbellana,* imported from England to control *Ulex europæus,* remained inactive in adult stage during "winter" months. [P. B.]

Nohira, Akio, "Biological notes on the early stages of *Luehdorfia japonica* Leech (Papilionidæ)" [in Japanese]. *Shin Konchu,* vol.3, no.3: pp.12-15, 2 figs., 4 tables. 1950.

Nohira, Akio, "Two separate emergences of the same broods of *Antheræa yamamai* Guérin (Saturniidæ)" [in Japanese]. *Shin Konchu,* vol.4, no.6: pp.10-11, 1 table. 1951.

Nolte, H.-W., "Parasiten der Nonne (*Lymantria monacha* L.) in Sachsen 1937-1941" [in German]. *Forstwiss. Zentralbl.*, vol.68: pp.183-188. 1949. Records 6 dipterous & 9 hymenopterous parasites & gives notes on their biology. [P. B.]

Norman, T., "Note on the larva of *Amblypodia centaurus.*" *Journ. Bombay nat. Hist. Soc.*, vol.48: p.814. 1949. When larva was kept isolated from ants, death resulted from infection with mold, beginning at honey gland opening. [P. B.]

Norman, T., "Notes on the Lepidoptera of Assam I." *Journ. Bombay nat. Hist. Soc.*, vol.50: pp.952-953. 1952. Describes larva & pupa of *Eribœa arja* (foodplant *Albizzia*) & *Cirrochroa aoris;* records *Prothoe franckii regalis.* [P. B.]

Notley, F. B., "The *Leucoptera* leaf miners of coffee on Kilimanjaro. II.-*Leucoptera caffeina* Wshbn." *Bull. ent. Res.*, vol.46: pp.899-912, 14 figs. 1956. Describes biology; compares all stages with those of *L. coffeella;* records parasites. [P. B.]

Nowakowski, J. T., "Mining insects of the Isle of Wolin and the Pziwnów Peninsula" [in Polish; Russian & English summaries]. *Prace Komisya biol., Poznanskie Tow. przyj. Nauk,* vol.15, no.1: 119 pp. 1955. Records 136 spp. of leaf-mining Lepidoptera, with foodplants (18 families of micros). [P. B.]

Nyholm, Tord, "Egendomlig förpuppningsplats för *Exapate congelatella* Cl. (Lep., Tortr.)" [in Swedish]. *Ent. Tidskr.*, vol.74: pp.162-163. 1953. Species pupating in exit holes of *Anobium* on apple. [P. B.]

Ohgushi, Ryohichi, "Ecological notes on *Epiponponia nawai* Dyar. a parasite of Cicada in Japan (Epipyropidæ)." *Trans. Shikoku ent. Soc.*, vol.3: pp.185-191, 6 figs., 2 tables. 1953. Habitat preference and morphological structure of cicada *Tanna japonensis* may be key points of the host determination of *E. nawai,* the author suggests. [T. I.]

Okagaki, Hiromu, "Larva and pupa of *Amata germana* Felder" [in Japanese]. *Trans. lep. Soc. Japan.*, vol.7: p.29, 2 figs. 1956. Figured; larva on *Ligustrum ibota* var. *angustifolium.* [P. B.]

Okano, Masao, "On (the life history of) *Zygæna niphona* Butler (Zygænidæ)" [in Japanese]. *Bull. Tohoku ent. Soc.*, vol.2: p.9, 2 figs. 1949.

Okano, Masao, "On larvæ and pupæ of two species of Noctuidæ (=Phalænidæ)" [in Japanese]. *Kontyû,* vol.18: pp.148-149. 1950. *Ramesa straminea* (food: *Sasaella ramosa*) & *Pterostoma sinicum* (food: *Robinia pseudacacia*). [T. I.]

Okano, Masao, "Eggs of *Metanastria subpurpurea* Butler (Lasiocampidæ)" [in Japanese]. *Insect Ecology,* vol.4, no.10: pp.25-26, 1 pl. 1952. Eggs are on the leaves of *Betula* sp. [T. I.]

Okano, Masao, "Notes on larva and pupa of *Nygmia nipphonis* Butler (Lymantriidæ)" [in Japanese]. *Insect Ecology,* vol.4, no.10: pp.23-25, 1 pl. 1952. Foodplant: *Corylus heterophylla* var. (Betulaceæ). [T. I.]

Okuno, Hiroshi, "Bionomics of *Eterusia ædea virescens* Butler (Zygænidæ)" [in Japanese]. *Shin Konchu,* vol.5, no.12: pp.19-21, 5 tables. 1952. Foodplants: various Theaceæ. [T. I.]

Olivier, R., "Note sur *Pamphila palæmon* Pallas" [in French]. *Rev. franç. Lépid.*, vol.15: pp.36-37. 1955. The larva of this hesperiid probably feeds on grass *Molinia cærulea.* [P. V.]

Olivier, R., "Observations sur *Heteropterus morpheus* Pallas et ses premiers états" [in French]. *Rev. franç. Lépid.*, vol.15: pp.34-36. 1955. Notes on the biology of *H. morpheus* in the NW of France. The larva lives on grass *Molinia cærulea,* but only in humid areas. [P. V.]

Olivier, R., "*Chloroclystis chlœrata* Mabille et ses premiers états (Geometridæ)" [in French]. *Rev. franç. Lépid.*, vol.15: pp.74-75. "1955" [1956]. Notes on the first stages of this geometrid. [P. V.]

Ono, Sachio, "A parasite on the larva of *Niphanda fusca* (Lycænidæ)" [in Japanese]. *New Entomologist,* vol.2, nos.3/4: pp.55-56, 2 figs. 1952. *Neotypus lapidator coreensis* (Ichneumonidæ). [T. I.]

Oord, W., "Kweek van *Ectropis bistortata* Goeze" [in Dutch]. *Ent. Berichten,* vol.15: p.456. 1955. Rearing notes.

Oord, W., "*Endromis versicolora* L." [in Dutch].*Ent. Berichten,* vol.16: p.11. 1956. Notes on biology; photo of larva. [P. B.]

Osanai, Minoru, "On the life-history of *Strymon* (=*Strymonidea*) *w-album fentoni* Butler" [in Japanese; English summary]. *Chûhô,* no.5: 12 pp., 2 pls. 1951. Food-plants *Rhamnus japonica* & *R. dahuricap* var. *nipponica.* [T. I.]

Ossowski, L. L. J., "The Hadedah Ibis, *Hagedashia hagedash hagedash* (Latham) and its relation to pest control in wattle plantations." *Ann. Natal Mus.,* vol.12: pp.279-290. 1952. Records 3 noctuids, 3 saturniids, and 1 tortricid, all said to defoliate wattle, taken from stomach contents of this bird; also 4 undetermined Pyralididæ. [P. B.]

Ossowski, L. L. J., "The biological control of the Wattle Bagworm (*Kotochala junodi* Heyl.) by a virus disease. I. Small-scale pilot experiments." *Ann. appl. Biol.,* vol.45: pp.81-89, 1 fig. 1957. Describes disease; records some parasites. [P. B.]

Ovington, J. D., & G. Scurfield, "Biological flora of the British Isles. *Holcus mollis* L." *Journ. Ecol.,* vol.44: pp.272-280, 2 figs. 1956. Records five species of *Elachista* mining in leaves. [P. B.]

Owen, D. F., "Larvæ of *Deilephila elpenor.*" *Ent. Rec. & Journ. Var.,* vol.64: pp.20-21. 1952. Apparent effect of crowding in producing dark larvæ; reluctance of jays to eat larvæ with "eye" markings visible. [P. B.]

Owen, D. F., "Habitat selection in *Argynnis aglaia* (L.) and *A. cydippe* (L.) in the British Isles." *Entomologist,* vol. 86: pp.128-129. 1953. Suggests that these spp. compete & replace each other ecologically; where both occur, former is found in open country & latter in woods, but north of range of *A. cydippe, A. aglaia* also occurs in woods. [P. B.]

Owen, D. F., "The habitats of *Pararge ægeria* L. in southern England." *Ent. Rec. & Journ.* Var., vol.65: pp.129-130. 1953. Woodland butterfly spreading into open areas. [P. B.]

Owen, D. F., "Habitat selection in *Pararge ægeria* (L.) (Lep., Satyridæ) in S. W. France." *Entomologist,* vol.87: pp.1-2. 1954. Attempt to correlate color & habitat; the brown French race flies in open country, the light-and-dark-marked British race was confined until recently to woodlands. [P. B.]

Paclt, Jiří, "K boji proti přástevníku *Hyphantria cunea*" [in Czech]. *Ochrana Rostlin,* vol.21: pp.160-163. 1948. About some methods of mechanical, chemical, and biological control of *H. cunea.* [J. M.]

Paclt, Jiří, "Krankheiten und Schädlinge der *Paulownia*" [in Slovak; Russian & German summaries]. *Biol. Sborník,* vol.7: pp.55-59. 1952. Insect pests and diseases of *Paulownia* spp. in Czechoslovakia. Some Lepidoptera are mentioned: *Apatele rumicis* and *Acherontia atropos.* [J. M.]

Paclt, Jiří, "Pests of the genus *Catalpa.*" *Biol. Jaarboek,* vol.19: pp.60-73, 4 pls. 1952. Records, from *Catalpa* spp., *Hyphantria cunea, Hyblæa puera, Apatele rumicis* (new record), *Ceratomia catalpæ, Acherontia atropos;* lists some parasites of *H. cunea* and *C. catalpæ.* [P. B.]

Paclt, Jiří, & Rudolf Schwarz, "Sind die Raupen der *Hyphantria cunea* (Insecta, Lepidoptera) im Stande Cellulose zu verdauen?" [in Slovak; Russian & German summaries]. *Biol. Sbornik,* vol.7: pp.143-149, 4 figs. 1952. Discusses the polyphagy of *H. cunea* larvæ. Some examples of destruction of paper are given. [J. M.]

Paramonow, S., "Hauptschädlinge der Ölkulturen der Ukraine" [in German]. *Zeitschr angew. Ent.,* vol.35: pp.63-81. 1953. Biology of *Homœosoma nebulellum*

on *Helianthus annuus; Etiella zinckenella* on *Glycine hispida; Phalonia epilinana* & *Chloridea dipsacea* on *Linum usitasissimum; Plutella maculipennis* on various oil-producing plants. [P. B.]

Pardi, L., "*Abraxas pantharia* (L.) defoliatrice del frassino" [in Italian]. *Mem. Soc. toscana Sci. nat., ser. B,* vol.55: pp.157-160. 1948. Outbreak of this geometrid on *Fraxinus excelsior.* [P. B.]

Parmenter, L., "Some records of bred Tachinidæ." *Ent. Rec. & Journ. Var,* vol.65: pp.29-31. 1953. List of 20 British spp., with their hosts, mostly Lepidoptera; some new records. [P. B.]

Parmenter, L., "*Amblyjoppa proteus* Christ (Hym.. Ichneumonidæ) bred from *Deilephila elpenor* L. (Lep., Sphingidæ)." *Ent. mo. Mag.,* vol.91: p.310. "1955" [1956].

Parsons, R. E., "Early stages of the butterfly *Delias aglaia* Linn." *Journ. Bombay nat. Hist. Soc.,* vol.47: pp.556-557. 1948. Describes pupa; notes on larva. Foodplant *Loranthus* sp. [P. B.]

Patel, G. A., R. R. Savoor, & A. C. Basu, "Some aspects of study in the life history of insects." *Science & Culture,* vol.15: pp.57-58. 1949. Gives data on duration of early stages of *Plutella maculipennis.* [P. B.]

Patel, R. C., & H. L. Kulkarny, "Bionomics of the Pumpkin Caterpillar—*Margaronia indica* Saund. (Pyralidæ: Lepidoptera)." *Journ. Bombay nat. Hist. Soc.,* vol.54: pp.118-127, 2 127, 2 pls. 1956. Describes all stages & life cycle; records 17 foodplants. [P. B.]

Patočka, Jan, "Raupen, die an Pappelblätter Schaden verursachen" [in Czech; Russian & German summaries]. *Práce Výzk. Ústavů Lesnických ČSR,* vol.5: pp.165-282, 44 pls. 1954. Very important study of the caterpillars living on *Populus* spp. in Central Europe; with keys for determination of all spp. [J. M.]

Patočka, Jan, "Bemerkungen über die Motte *Cerostoma coriacellum* an der Tanne" [in Slovak; Russian & German summaries]. *Biológia,* Bratislava, vol.10: pp.361-367, 9 figs. 1955. Contribution to the knowledge of the genus *Cerostoma* with description of larva and pupa of *C. coriacellum.* [J. M.]

Patočka, Jan, "Zur Frage der Überwinterung der an Eichen schädlichen Schmetterlinge und der Kontrolle der Eichenwickler mit Hilfe der überwinterten Eier" [in Czech; Russian & German summaries]. *Lesnicky Casopis,* vol.1: pp.17-42, 16 figs. 1955. Ecological study about the harmful Lepidoptera from Slovakian forests. [J. M.]

Patočka, Jan, "Die Motte *Tachyptilia disquei* Meess—ein Schädling an *Quercus cerris* in der Slowakei" [in Czech; German & Russian summaries]. *Folia zoologica,* vol.5: pp.111-120, 8 figs. 1956. Describes biology & gives data on economic importance of the sp. [J. M.]

Paulian, Patrice, "Notes biologiques sur le *Pringleophaga kerguelenensis* End." [in French]. *Rev. franç. Ent.,* vol.20: pp.45-47. 1953. Notes on biology; reared on *Pringlea* & *Acœna.* [P. B.]

Peakall, D. B., "Some notes on the Red-spotted Bluethroat." *Brit. Birds,* vol.49: pp.135-139, 1 fig. 1956. Larvæ of *Oporinia autumnata* fed to young birds, in Lapland. [P. B.]

Peterson, G. D., jr., "Biological control of the European Corn Borer on Guam." *Journ. econ. Ent.,* vol.48: pp.683-685. "1955" [1956]. *Pyrausta nubilalis* was first recorded in Guam in 1911. Several parasites were introduced; *Lydella stabulans grisescens* became established and kept the borers down for many years. About 1950 the borer again became abundant, and *Lydella* was scarce. Further introductions of this and other spp. in 1952 and 1954 were not able to become established. The reason for the disappearance of *Lydella* is not known. [W. C.]

Pfeffer, Antonín, "Les insectes comme composants de la biocénose du sapin pectiné [in Czech; Russian & French summaries]. *Acta Soc. ent. Čechosloveniæ,* vol.52: pp.77-92. 1956. Gives a survey of all insects living in the immature stages on *Abies alba.* Lists 32 spp. of Lepidoptera, of which 6 spp. are pests. [J. M.]

Pinker, Rudolf, "Beschreibung der Raupen einiger pontischer und mediterraner Heteroceren" [in German]. *Zeitschr. wiener ent. Ges.*, vol.41: pp.265-270, 1 pl., 6 figs. 1956. Describes larvæ of *Agrochola wolfschlägeri, A. thurneri. A. lectiflora, A. meridionalis, Orrhodiella ragusæ,* & *Calostigia wolfschlägeræ;* color photos of all except *A. meridionalis.* [P. B.]

Pinker, Rudolf, "Lebensraum und Verhalten von *Euchloe charlonia* Donz. in Mazedonien" [in German]. *Zeitschr. wiener ent. Ges.*, vol.42: pp.81-85, 1 pl., 2 figs. 1957. Describes habitat & biology; foodplant *Mattiola thessalo.* [P. B.]

Popendiker, Kurt, "Die in Vogelnestern lebenden Insekten unter besonderer Berücksichtigung der als Haus—und Vorratsschädlinge auftretende Arten" [in German]. *Mitt. hamburg. zool. Mus. Inst.*, vol.54: pp.49-127, 12 figs. 1956. Survey of biology of insects in birds' nests; 12 Lepidoptera included (Tineidæ, Œcophoridæ, Pyralidæ, *Acidalia virgularia*). [P. B.]

Postans, A. T., "Hibernation of *Plusia festucæ* L." *Ent. Rec.* & *Journ. Var.*, vol.65: pp.294-295. 1953. Hibernates as young larva. [P. B.]

Postner, M., "Schädigung von Nadelholzjungpflanzen durch Raupen von *Cnephasia incertana* Tr. (Lepidoptera, Tortricidæ)" [in German]. *Forstwiss. Zentralbl.*, vol.75: pp.563-567, 3 figs. 1956. Describes & figures stages except egg; pest of young conifers. [P. B.]

Povolný, Dalibor, "Zur Bionomie der Rübenmotte *Gnorimoschema ocellatellum* Boyd in der Tschechoslowakei" [in Czech; Russian & German summaries]. *Folia Zool. Ent.*, vol.4: pp.281-188. 1955. Describes the bionomy of *G. ocellatellum* in Southern Slovakia; corrects the mistaken views of Drachovská, published in agricultural periodicals. [J. M.]

Prebble, M. L., & R. F. Morris, "The Spruce Budworm problem." *Forestry Chron.*, vol.27: pp.14-22. 1951. Review of biology of *Choristoneura fumiferana* with reference to outbreaks and their control. [P. B.]

Prevett, P. F., "Fauna of a dead pheasant in London, S. E. 27." *Ent. mo. Mag.*, vol.90: p.3. 1954. Including *Tinea pellionella* & *Hoffmannophila pseudospretella.* [P. B.]

Příhoda, Antonín, "*Trichoptilus paludum* Zell. a rare butterfly feeding on *Drosera*" [in Czech; Russian & English summaries]. *Ochrana Přírody*, vol.5: pp.34-36, 4 figs. 1950. Short article on the biology of this moth, recorded in Bohemia by Zimmerman in 1943. [J. M.]

Proctor, M. C. F., "Biological flora of the British Isles. *Helianthemum* Mill." *Journ. Ecol.*, vol.44: pp.675-692, 4 figs. 1956. Lepidoptera recorded on this foodplant are: *Plebejus argus cærnensis, Aricia agestis, Procris geryon, Sterrha dilutaria, Xenolechia sequax, Mesophleps silacella, Mompha miscella, Scythris fuscoænea, S. fletcherella, S. falacella,* & *Coleophora ochrea.* [P. B.]

Prüffer, Jan, "Some observations concerning *Zophodia convolutella* Hb. (Lep.)" [in Polish; English summary]. *Bull. ent. Pologne,* vol.18: pp.24-30, 1 pl. 1948. Describes the life history of this sp., in Wilno. Figured are some moths & cocoons. [J. M.]

Puchta, Otto, & Hans Wille, "Ein parasitisches Bakterium im Mitteldarmepithel von *Solenobia triquetrella* F. R. (Lepid., Psychidæ)" [in German]. *Zeitschr. Parasitenk.*, vol.17: pp.400-418, 9 figs. 1956. Study of a bacterium from the midgut of larvæ of this psychid. Describes digestive tract of larva. [P. B.]

Puttarudriah, M., & G. P. Basavanna, "A study on the identity of *Bracon hebetor* Say and *Bracon brevicornis* Wesmael (Hymenoptera: Braconidæ)." *Bull. ent. Res.*, vol.47: pp.183-191. 1956. Lists lepidopterous hosts. Parasites conspecific. [P. B.]

Quednau, Wolfgang, "Der Wert des physiologischen Experimentes für die Artsystematik von *Trichogramma* (Hym. Chalcididæ)" [in German]. *Bericht über die Hundertjahrfeier der Deutschen Entomologischen Gesellschaft, Berlin*: pp.87-92, 5 figs. Berlin: Akademie-Verlag. 1957. Biological data indicate distinctness of 5 superficially indistinguishable spp. of egg parasites of Lepidoptera; all will lay in *Barathra* eggs, but 2 avoid eggs of *Galleria* and 3 avoid eggs of *Pieris.* [P. B.]

Rabb, R. L., & F. R. Lawson, "Some factors influencing the predation of *Polistes* wasps on the Tabacco Hornworm, *Protoparce sexta* (Johan.)." *Bull. ent. Soc. Amer.*, vol.3: pp.26-27. 1957. Abstract.

Radcliffe, D. N., "An appraisal of seed damage by the Douglas Fir Cone Moth, in British Columbia." *Forestry Chron.*, vol.28. no.2: pp.19-24. 1952. *Barbara colfaxiana* (Eucosminæ).

Raizenne, Henri, *Forest Lepidoptera of southern Ontario and their parasites, received and reared at the Ottawa Forest Insect Survey Laboratory from 1907 to 1948.* 277 pp., 1 map. Ottawa: Dept. Agric., Canada. 1952. Records of some 450 spp., giving foodplants, parasites, months when collected, & local distribution. [P. B.]

Rayment, T., "Butterflies on mud." *Victorian Nat.*, vol.70: p.176. Jan. 1954. Reports large concentrations of the butterfly *Danaida archippus* (*Danaus plexippus*) in the Mt. Lofty Range, South Australia. [I. C.]

Razowski, J., "Notes on biology of *Cacœcia podana* Scop. (Tortricidæ)" [in Polish; English summary]. *Bull. ent. Pologne*, vol.25: pp.73-74, 3 figs. 1956.

Reid, E. T. M., "Insect diet of the Buff-backed Heron or Tick-bird (*Bubulcus ibis* (Linn.)) (Ardeidæ) in the southern Sudan." *Ent. mo. Mag.*, vol.91: pp.169-173. 1955. Stomach contents included larval & adult Lepidoptera, not determined below family. [P. B.]

Reiff, M., "Untersuchungen zum Lebenszyklus der Frostspanner *Cheimatobia* (*Operophthera*) *brumata* L. und *Hibernia defoliaria* Cl." [in German]. *Mitt. Schweiz. ent. Ges.*, vol.26: pp.129-144, 4 figs. 1953. In these spp., which have wingless ♀♀ & are therefore sedentary, local races differing in innate physiological adaptations to local climates have developed. Exogenous & endogenous elements controlling life cycle are described. [P. B.]

Remington, Charles L., "The biology of nearctic Lepidoptera. I. Foodplants and life histories of Colorado Papilionoidea." *Psyche*, vol.59: pp.61-70. 1952. Foodplant & oviposition records for 11 spp. (Papilionidæ, Pieridæ, Satyridæ, Nymphalidæ). [P. B.]

Remington, Charles L., "The biology of nearctic Lepidoptera. II. Foodplant and pupa of *Hemiargus isolus*." *Psyche*, vol.59: pp.128-130. "1952" [1953]. Describes pupa; foodplant *Prosopis juliflora*. [P. B.]

Riabov, M. M., "Tipy povedeniya imaginal 'noy fasy podgryzayustshikh sovok" [in Russian; Types of behavior of the imaginal stage of some cutworms]. *Ent. Obozrenie*, vol.32: pp.167-175. 1952. Corresponding to observations in Caucasus, divides agrotids into three groups, using the time of sexual puberty and feeding as a base. Describes biology, flight, copulation, imaginal diapause, aphagy, & nuptial flight of males. [N. O.]

Ritchie, J. C., "Biological flora of the British Isles. *Vaccinium myrtillus* L." *Journ. Ecol.*, vol.44: pp.291-299, 3 figs. 1956. Records 20 Lepidoptera (Noctuidæ, Geometridæ, Lymantriidæ, Tortricidæ, Eucosmidæ, Coleophoridæ, Stigmellidæ) feeding on this plant. [P. B.]

Robertson, Phyllis L., "*Eupteromalus* sp. as a hyperparasite. Some indication of its influence on the establishment of *Angitia cerophaga* in New Zealand." *N. Z. Journ. Sci. Tech., Sect. B*, vol.29: pp.257-265. 1948. Attacks various parasites of *Pieris rapæ* & *Plutella maculipennis*. [P. B.]

Roediger, Heinz, "Untersuchungen über den Rindenwickler *Enarmonia woeberiana* Schiff. (Lepid. Tortr.)" [in German]. *Zeitschr. angew. Ent.*, vol.38: pp.295-321, 19 figs. 1956. Describes adults (including external & internal genitalia) & early stages, in considerable detail, biology of all stages, & control measures. Gives synonymy. Moth attacks *Prunus* spp. & other fruit trees & occurs throughout the Palearctic region. 4 parasites are recorded. [P. B.]

Roegner-Aust, Sophia, "Der Infektionsweg bei der Polyederepidemie der Nonne" [in German]. *Zeitschr. angew. Ent.*, vol.31: pp.3-37, 5 figs. 1949. Concludes, from studies on *Lymantria monacha* and *Bombyx mori*, that the polyhedral virus disease which helps to control the former is transmitted through the egg. [P. B.]

Roegner-Aust, Sophia, "Populationsanalytische Untersuchungen über die Sterblichkeit van Nonnenraupen" [in German]. *Zeitschr. angew. Ent.*, vol.31: pp.181-207, 5 figs. 1949. Study of numerous populations of *Lymantria monacha* with regard to health of larvæ; points out strong differences between populations, and within same population at different times, in frequency of infectious diseases. [P. B.]

Roehrich, R., "Le parasitisme naturel de la tordeuse du pêcher (*Laspeyresia molesta* Busck) dans le Sud-Ouest de la France (Lep. Olethreutidæ)" [in French]. *Bull. Soc. ent. France,* vol.59: pp.14-16. 1954. Records 10 parasites (9 attacking larva); all are rare, and no native parasite seems to seems to have adapted to this species in SW France. [P. B.]

Roer, H., "Tagschmetterlinge als Vorzugsnahrung einiger Singvögel" [in German]. *Journ. Ornithol.,* vol.98: pp.416-420. 1957. *Passer montanus* & other birds feeding on *Pieris brassicæ;* at least 10% of individuals released in one experiment on migration were eaten. [P. B.]

Ronniger, Hermann, "Über *Coleophora* (*Eupista*) *flaviella* Mann. Eine weitere Mitteilung" [in German]. *Zeitschr. wiener ent. Ges.,* vol.40: pp.149-150. 1955. Notes on biology; larva on seeds of *Coronilla coronata,* overwintering twice before emergence. [P. B.]

Roonwal, M. L., "Structure of egg-masses and their hairs in some species of *Lymantria* of importance to forestry (Insecta: Lepidoptera: Lymantriidæ)." *Indian Forester,* vol.80: pp.553-559, 1 pl., 5 figs. 1954. Describes & figures both; distinguishes *L. mathura, L. obfuscata,* & *L. dispar* on structure of hair (from ♀ anal tuft) covering egg mass. [P. B.]

van Rossem, G., "Verslag over het optreden van enige schadelijke insecten in het jaar 1953" [in Dutch; English summary]. *Ent. Berichten,* vol.15: pp.246-252. 1954. Report on economically important insects. [P. B.]

van Rossem, G., "Verslag over het optreden van enige schadelijke insecten in het jaar 1954" [in Dutch; English summary]. *Ent. Berichten,* vol.15: pp.360-365. 1955. Includes record of *Tinea pallescentella* breeding in enchytræid worm culture. [P. B.]

van Rossem, G., "Verslag over het optreden van enige schadelijke insecten in het jaar 1956" [in Dutch; English summary]. *Ent. Berichten,* vol.17: pp.57-62. 1957.

Rost, Helmut, "Über das Geschlecht der Puppen des Seidenspinners in Doppelkokons" [in German]. *Wiss. Zeitschr. Univ. Jena,* vol.2: pp.13-16, 4 figs. "1952/53". Double cocoons of *Bombyx mori* contain an excess of ♀♀ over expectation. [P. B.]

Rougeot, P. C., "Des attacides buveurs: les *Epiphora* africains" [in French]. *Rev. franç. Lépid.,* vol.16: pp.6-9. 1957. A classic character of the family Attacidæ is: proboscis reduced or absent; the author has observed in Gaboon (French Equatorial Africa) a genus of saturniids, *Epiphora,* that absorb water by the proboscis and eject it by the anus like some papilionids, pierids, nymphalids, & lycænids. It is a very interesting observation. [P. V.]

Rougeot, P. C., "Les premiers états de *Pseudobunæa cleopatra* Auriv. (Lepid. Attacidæ)" [in French]. *Bull. mens. Soc. linn. Lyon,* vol.26: pp.108-109. 1957. Larval first stages of *P. cleopatra* in French Equatorial Africa (Gaboon). [P. V.]

Rudolf, Paul O., "Red Pine and the European Pine-shoot Moth in southern Michigan." *Pap. Michigan Acad. Sci. Arts Lett.,* vol.35: pp.61-67, 1 pl., 1 map. 1951. Biology & control of *Rhyacionia buoliana.* [P. B.]

Rüttiman, Marcel, "Eine *ex ovo* Zucht von *Antheræa mylitta* Fabricius" [in German]. *Ent. Nachrichtenbl.,* Burgdorf, vol.3: pp.1-3. 1949. Describes rearing, on oak. [P. B.]

de Ruiter, L., "Some experiments on the camouflage of stick caterpillars" [in English; German summary]. *Behaviour,* vol.4: pp.222-232, 4 figs. 1952. In experiments with jays & chaffinches as predators, effectiveness of resemblance of some geometrid larvæ to twigs is demonstrated. Larvæ are confused by birds only with twigs of their own foodplants. Birds hunt larvæ actively only when stimulated by finding one accidentally and lose interest in hunting after testing a series of "twigs" and finding them all wood. [P. B.]

de Ruiter, L., "Countershading in caterpillars. An analysis of its adaptive significance" [in English; German summary]. *Arch. neerl. Zool.*, vol.11: pp.285-341, 4 pls., 7 figs. 1956. Shows that countershaded larvæ turn their darkest surface toward light in natural conditions; this reduced their visibility by cancelling greater brightness of illuminated surface. In experiments with jays as predators, larvæ with countershading painted out or made useless by abnormal positions were caught with greater frequency than normally colored larvæ in normal positions. Perception of shading of solid objects by jays was demonstrated experimentally. Evidence indicates that countershading is of value in concealing larvæ from predators. [P. B.]

Rungs, Ch., "Contribution à la connaissance des ennemis de l'arganier" [in French]. *Bull. Soc. Sci. nat. Maroc,* vol.32: pp.61-76. 1953. *Ephestia cautella* & *Myelois ceratoniæ* feed on nuts; *Taragama repanda* & *T. regraguii* probably feed on foliage. [P. B.]

Ruwet, M., "A propos d'un élevage de *Eriogaster lanestris* Linné" [in French]. *Lambillionea,* vol.56: p.34. 1956. Note on breeding of the lasiocampid *E. lanestris.* [P. V.]

Ryszka, Hans, "Die Zucht von *Perigrapha 1-cinctum* Schiff." [in German]. *Ent. Nachrichtenbl.,* Burgdorf, vol.3: pp.73-75. 1949. Describes rearing, on *Convolvulus arvensis* & *Tussilago farfara.* [P. B.]

Sakaguti, Kôhei, & Haruo Fukuda, "*Hebemoia glaucippe* on Satamisaki, the southernmost part of Kyusyu" [in Japanese; English summary]. *Trans. lep. Soc. Japan,* vol.7: pp.4-5, 1 pl. 1956. Northernmost locality for this tropical pierid. Color photographs of adult & early stages; foodplant *Cratæva religiosa.* [P. B.]

Sakakibara, Shigeru, "Life-history of *Favonius orientalis* Murray (Lycænidæ)" [in Japanese]. *Collecting & Breeding,* vol.12: pp.221-222, 2 figs. 1950. Foodplants: *Quercus spp.* [T. I.]

Sala, Frank, "Life history notes on *Palada scarletina* Smith." *Bull. Southern Calif. Acad. Sci.,* vol.54: pp.151-155, 5 figs. 1956. Describes & figures mature larva & pupa; notes on distribution & phenology (dependent on flowering of the foodplants, *Stephanomeria* spp.). [P. B.]

Sala, Frank P., & Charles L. Hogue, "Descriptions of the early stages and male imago and notes on the life history of *Saturnia walterorum* (Saturniidæ)." *Lepid. News,* vol.12: pp.17-25, 18 figs. 1958.

Salmon, J. T., "Vegetable caterpillars." *Tuatara,* vol.4: pp.1-3. 1951. Records the fungus *Cordiceps robertsii* attacking ground-tunnelling larvæ of *Porina signata, P. enysii,* & *Hepialus virescens* (Hepialidæ). [I. C.]

Salmond, K. F., "The insect and mite fauna of a Scottish flour mill." *Bull. ent. Res.,* vol.47: pp.621-630. 1956. Records 6 Lepidoptera (Noctuidæ, Pyralididæ, Œcophoridæ, Tineidæ). [P. B.]

Salt, G., "Experimental studies in insect parasitism. X. The reactions of some endopterygote insects to an alien parasite." *Proc. Roy. Soc. London (B),* vol.147: pp.167-184, 2 pls. 1957. Larvæ & pupæ of *Diataraxia oleracea* form cysts around injected eggs of the ichneumonid *Nemeritis canescens;* in adults encystment does not take place and parasites develop normally. [P. B.]

de Santis, Mateo A., "Lagarta rosada *Platyedra gossypiella* en capsulas de palo borracho" [in Spanish]. *Rev. Invest. agric.,* vol.1: pp.287-290, 2 figs. 1947. New foodplant record: *Chorisia* spp. New record for Argentina. [P. B.]

Sarlet, L., "Iconographie des oeufs de lépidoptères (faune de la Belgique) (suite)" [in French]. *Lambillionea,* vol.54: pp.45-49. 1954. Descriptions of eggs of *Pieris rapæ, Pontia daplidice, Anthocaris cardamines.* [P. B.]

Sarlet, L., "Iconographie des oeufs de lépidoptères (faune de la Belgique)" [in French]. *Lambillionea,* vol.55: pp.59-64, 67-77, 1 pl.; pp.94-96. 1955. Iconography of eggs of Lepidoptera of Belgium: Nymphalidæ, subfamilies Melitæinæ and Argynninæ. [P. V.]

Sarlet, L., "Iconographie des oeufs de lépidoptères (faune de la Belgique) (suite)" [in French]. *Lambillionea,* vol.55: pp.94-97; vol.56: pp.6-7, 35-36. 1955, 1956. Describes eggs of *Brenthis aquilonaris, B. dia, Argynnis ino,* & *A. lathonia.* [P. B.]

Sarlet, L., "Iconographie des oeufs de lépidoptères (faune de la Belgique) (suite)" [in French]. *Lambillionea,* vol.56: pp.43-48. 1956. Notes on the eggs of *Argynnis niobe, A. adippe,* & *A. paphia* (all experimental laying). [P. V.]

Sarlet, L., "Iconographie des oeufs de lépidoptères (faune de la Belgique) (suite)" [in French]. *Lambillionea,* vol.56: pp.68-76, 93-101. 1956. Iconography of the eggs of *Brenthis daphne, Limenitis camilla, Vanessa atalanta, Nymphalis antiopa, N. io, Erebia medusa brigobanna, E. æthiops peneplana, E. ligea carthusianorum,* & *Agapetes galathea,* [P. V.]

Sarlet, L., "Iconographie des oeufs des lépidoptères" [in French]. *Lambillionea,* vol.57: pp.11-27. 1957. Iconography of eggs of *Hipparchia fagi, H. semele, Satyrus bryce, Brintesia circe, Aphantopus hyperanthus, Maniola jurtina, Pyronia tithonus, Pararge egeria vulgaris, Lasiommata megera, L. mæra adrasta* (all Satyridæ). [P. V.]

Sauter, W.. "Zur Biologie des Gabelschwanzes, *Dicranura vinula* L. (Lep. Notodontidæ)" [in German]. *Mitt. thurgauische naturf. Ges.,* vol.34: pp.33-38. 1947. Describes early stages, rearing, phenology, & habits of adult. [P. B.]

Sauvaut, André, & Keutgens, "Insectes récoltés sur le cotonnier et autres plantes en Côte d'Ivoire" [in French]. *Bull. Soc. Hist. nat. Toulouse,* vol.84: pp.22-24. 1949. Lists 10 spp. (Noctuidæ, Arctiidæ, Pyralidæ, Tineidæ, Gelechiidæ) feeding on cotton plant. [P. B.]

Schätz, Willi, "Beobachtungen an *Psyche viciella* Schiff. (Lep. Psychidæ)" [in German]. *Nachrichtenbl. bayer. Ent.,* vol.4: pp.102-104, 107, 109, 118-119. 1955. Details of biology of all stages. Case of facultative parthenogenesis reported. [P. B.]

Schedl, Karl E., "Der Kiefernspinner an Fichte" [in German]. *Allg. forst.- und holzwirtsch. Zeitung,* vol.60: p.29. 1949. *Bupalus piniarius* larvæ common in pure spruce stands; usual foodplant pine. [P. B.]

Schiebe, A., "Die phänophasisch bedingte Typenresistenz der Erbsensorten gegen den Erbsenwickler (*Grapholitha nigricana* Steph., =*Laspeyresia* (*Cydia*) *nigricana* Steph.)" [in German]. *Phytopathol. Zeitschr.,* vol.21: pp.433-448, 5 figs. 1954. Races of *Pisum* with short flowering period which precedes flight period of moth are subject to least attack. [P. B.]

Schimitschek, Erwin, "Durch Polyederkrankheit im Ei abgestorbene Nonnenraupen" [in German]. *Österreichs Forst- und Holzwirtsch.,* vol.4: p.55. 1949. Virus disease of *Lymantria monacha* eggs. [P. B.]

Schimitschek, Erwin, "Forstentomologische Studien im Urwald Rotwald" [in German]. *Zeitschr. angew. Ent.,* vol.34: pp.178-215, 513-542, 18 figs. 1952; 1953. Includes notes on biology of *Scardia tessulatella,* on conifers; *Borkhausenia similella,* on dead fruiting bodies of *Fomes* and *Gonoderma.* [*P. B.*]

Schimitschek, Erwin, "*Boarmia bistortata* Goeze als Lärchenschädling" [in German; English summary]. *Zeitschr. angew. Ent.,* vol.40: pp.37-51, 16 figs. 1957. Study of outbreak in larch stand. Describes early stages, with notes on biology; records parasites. [P. B.]

Schmidt, H., "*Cossus cossus* L." [in German]. *Holz als Roh- und Werkstoffe,* vol.9: pp.473-474, 4 figs. 1951. Biology & identification. [P. B.]

Schneider, F., "Auftreten und Bekämpfung einiger Obstschädlinge in Syrien" [in German; English summary]. *Zeitschr. Pflanzenkrankh.,* vol.64: pp.613-619. 6 figs. 1957. Includes notes on biology of *Carpocapsa pomonella* in Syria. [P. B.]

Schneiders, Hildegard, "Das Schlüpfen des Falters von *Aporia crataegi* L. aus der Puppe" [in German]. *Zeitschr. Pflanzenkrankh.,* vol.62: pp.561-563, 10 figs. 1955. Excellent series of photos of emerging adult. [P. B.]

Schütte, Friedrich, "Untersuchungen über die Populationsdynamik des Eichenwicklers (*Tortrix viridana* L.)" [in German; English summary]. *Zeitschr. angew. Ent.,* vol.40: pp.1-36, 285-331, 45 figs. 1957. Study of economic biology. Factors affecting population size are analyzed. Coincidence of larval emergence with opening of oak leaf buds is most favorable for larval development. Various predators, including larvæ of *Epinotia corticana,* and parasites recorded. [P. B.]

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NOTES ON OVERLAPPING SUBSPECIES. II. SEGREGATION IN THE *SPEYERIA ATLANTIS* OF THE BLACK HILLS (NYMPHALIDAE)

by L. P. GREY, A. H. MOECK and W. H. EVANS

The authors have differing interests joined here in common cause. GREY studies distribution, morphology, and population structure of *Speyeria;* MOECK has broad acquaintance with Nearctic environments and butterfly populations; EVANS is one of the few who have mastered the tricky art of rearing *Speyeria.* EVANS'S data are given separately, accreditable to him in entirety; the bulk of records and field notes are MOECK'S, as are the maps; organization is by GREY, who is responsible also for suggested evaluations.

The title perhaps should have been qualified; the two described color forms apparently behave as separate "species" in the Black Hills although treated here as "subspecies" of *Speyeria atlantis* (Edwards). If they are indeed two unrelated organisms their differences in behavior and in larval and adult morphology deserve only brief description. The question of relationship will be passed over without prejudice, reserving opinion that expanded knowledge of total distributions in "species" like these will necessitate some amendments to present categorical rigidity.

GREY and MOECK (1962) stated a belief that the largest factor controlling population structure in butterflies is the residual inertia of genetic heritage, inferring that wing facies reflect earlier dispersal and isolation, relating only secondarily to present situations. Deduction of late glacial migrations from facts of present distribution has a large literature attesting that others share these apprehensions and the underlying assumption that wing facies must be relatively durable in

time. However, studies often appear to indicate quite the opposite: breeding experiments show large genetic susceptability of short-term modification, and field samples reveal innumerable instances of variation correlated to particular environments, the usual interpretations of which are of "control" or "cause" by immediate factors in local environments. One or the other of these viewpoints must be seriously defective.

Following data demonstrate apparent control over population structure by factors in a present ecologic confinement, ostensibly showing that observed divergence is being encouraged or even "caused" by selective tailoring to fit the environmental cloth, the obvious correlations being analogous with those often cited as providing evolutionary mechanisms.

Exploring consequences of the latter view, of environmental pliability, which would be fatal philosophically to the conception of species developing at the slow rate allowing some present tracing of past wanderings, distributions cited in present papers are believed to represent recent contacts of intraphyletic segregates. Coercion provided by supposedly potent evolutionary factors in ecology and climate then become identical for two partially separately evolved "subspecies", which should encourage rapid blending. It appears in *Speyeria* populations, to the contrary, that present environments merely channel capacities for variations which correlate still better with inferred earlier histories and with the unknown inertial factor inasmuch as divergency remains far sharper than would seem demanded by present ecogeography. In these occurrences probably lie the best chances to arrive at some estimation of "species" and "subspecies" as they relate to time, which is the point of view suggested by examples like the following one.

MATERIAL

Photographs (see the plate) in black-and-white cannot do justice to the disparity of the color forms discussed herein. One of these (specimens A through F) is basally and marginally light above, with pale brick disk and unsilvered spots below; this form is termed "*lurana*", which is an available name for the Black Hills equivalent of the Colorado "*hesperis*" series. The other variety is darker above and has a blackish disk with silvered spots, nearly in the facies of nominotypical Appalachian *atlantis;* the tag used for this variation therefore will be "*atlantis*" (NOTE:— names herein are cited to take advantage of their descriptive values, non-categorically). Specimens G through L are illustrative of this Black Hills "*atlantis*"; speciments M, N, O are variant extremes: M approaches the "*tetonia*" of western Wyoming; N is dwarfed, has solid borders, touches of silver, reddish disk; O is silvered like "*atlantis*" but is intermediate toward "*lurana*" in discal color.

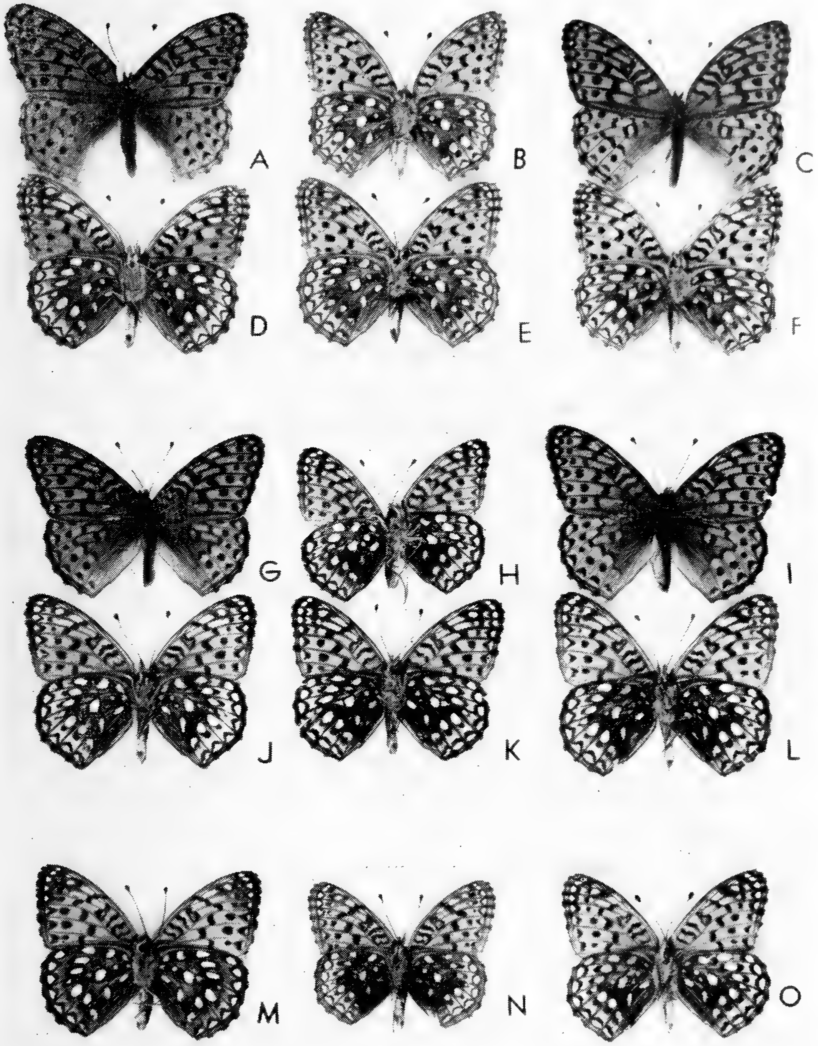


Figure 1: *Speyeria atlantis* (all males). Black Hills.

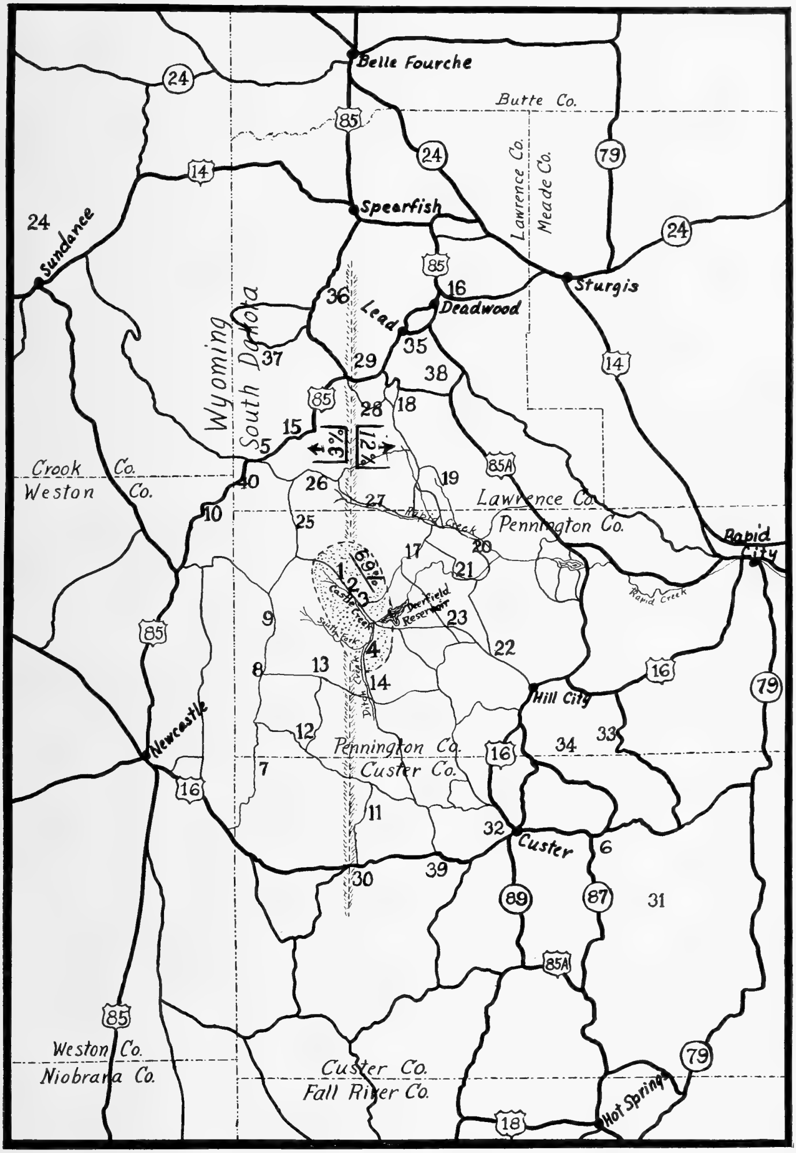
Site locations given in record table on maps 1-3:

A-F: *"lurana"* from sites 10, 40, 40, 10, 25, 17 respectively.
G-L: *"atlantis"* from sites 19, 3, 3, 1, 6, 1.
M-O: extreme variants from sites 40, 40, 4.

[Photograph by KENNETH MACARTHUR at the Milwaukee Museum.]

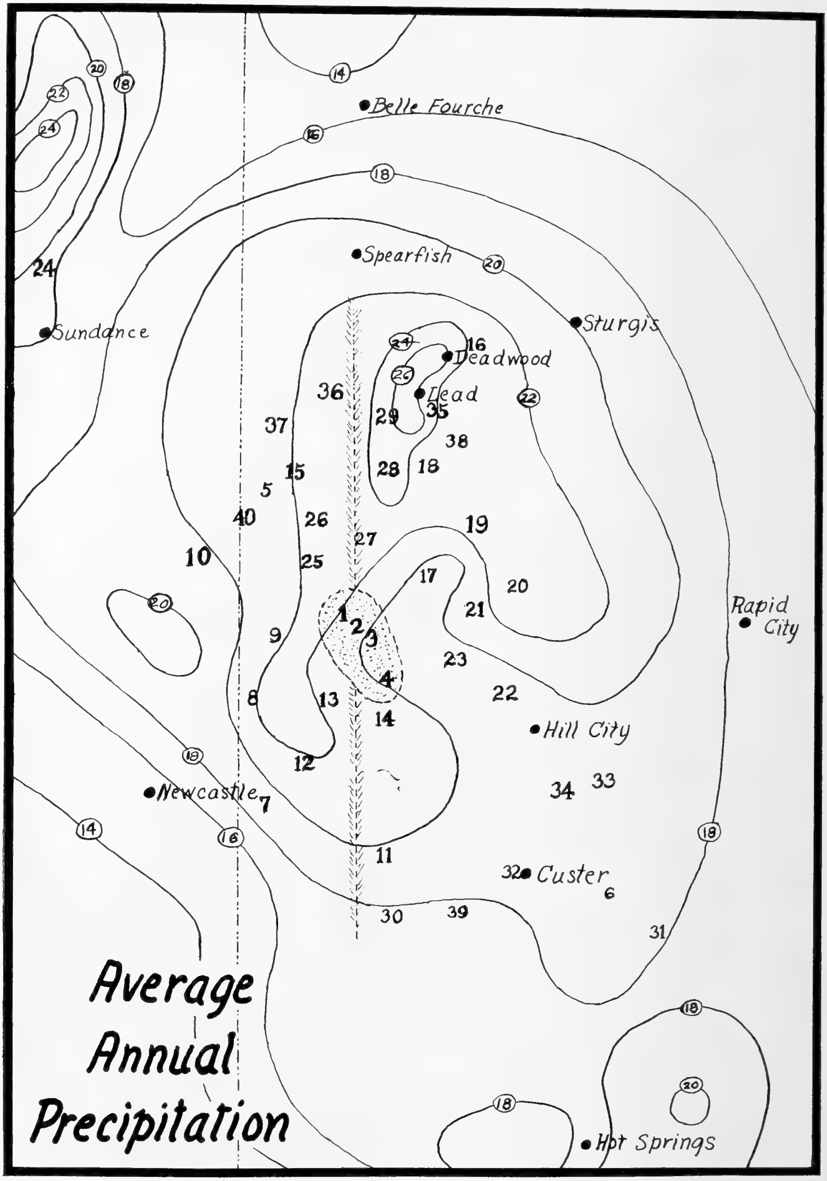
SOME BLACK HILLS RECORDS OF S. "*ATLANTIS*" AND "*LURANA*"

County and State	Map Symbol	Locality	Sample Size	% "A"
Custer Co., So. Dakota	6	intersection Hy. 16A & 87	6	33.3
	31	Custer State Park	19	31.6
	32	vic. Custer	9	22.2
	7	Boyles Canyon road	14	0.0
	11	Mud Springs road	13	0.0
	30	vic. Jewel Cave	26	0.0
	39	6 mi. E of Jewel Cave on Hy. 16	14	7.1
Pennington Co., So. Dakota	8	Moon campsite	2	0.0
	9	6 mi. N of Moon	2	0.0
	12	8 mi. S E of Moon	27	0.0
	13	5 mi. E of Moon	10	0.0
	22	9 mi. S E of Deerfield	19	5.2
	23	6 mi. E of Deerfield	13	7.6
	4	3 mi. S of Deerfield	35	42.8
	14	6 mi. S of Deerfield	40	12.5
	17	8 mi. N E of Deerfield	78	3.9
	3	2 mi. N W of Deerfield	73	90.4
	2	3 mi. N W of Deerfield	36	63.8
	1	7 mi. N W of Deerfield	72	62.7
	25	14 mi. N W of Deerfield	30	0.0
	20	1 mi. N of Mystic	38	10.5
	21	3 mi. S W of Mystic	26	3.8
	33	vic. Mt. Rushmore	5	0.0
	34	vic. Harney Peak	89	20.2
Lawrence Co., So. Dakota	35	vic. Lead	5	0.0
	36	Spearfish Canyon	19	0.0
	29	Terry Peak	5	0.0
	37	12 mi. S of Spearfish	3	0.0
	18	7 mi. S W of Lead	28	0.0
	38	6 mi. S of Deadwood	4	0.0
	16	2 mi. E of Deadwood	3	0.0
	28	vic. Hanna	18	16.6
	27	vic. Deerdale campsite	73	15.0
	26	5 mi. W of Rochford	36	5.5
	19	3 mi. N of Rochford	23	39.1
	15	3 mi. N of O'Neill Pass	7	14.2
	5	vic. O'Neill Pass	2	0.0
	40	3 mi. S of O'Neill Pass	12	0.0
Crook Co., Wyo.	24	5-6 mi. N of Sundance	30	6.6
Weston Co., Wyo.	10	Buckhorn – Four Corners road	36	5.5



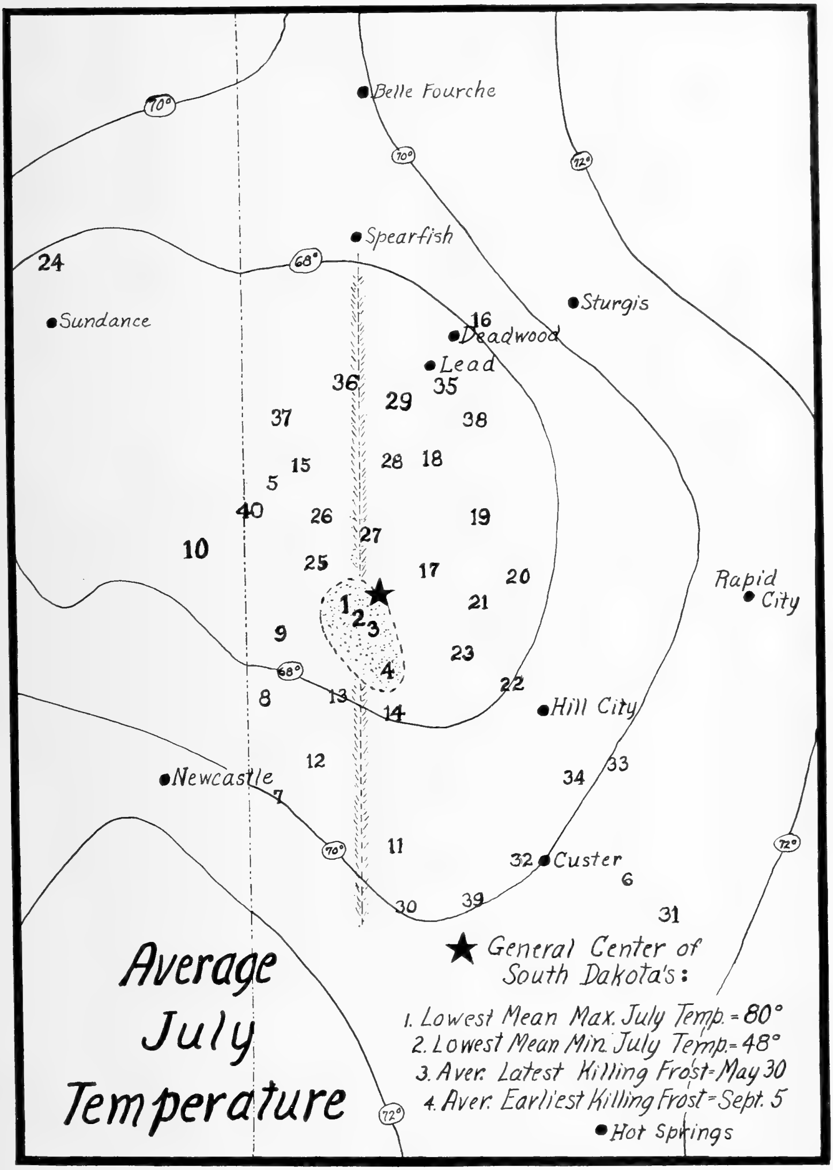
Map 1: Road network and collecting sites, Black Hills.

U. S. Hy. numbers in shields, State Hy. numbers in circles. Forest Service roads unnumbered (thin lines). Localities numbered 1-40 are as tabulated in the list of records. The shaded central region and shaded axis line delimit areas referred to in the text.



Map 2: Rainfall and collecting sites, Black Hills.

Isobars with average precipitations in inches, encircled. Numbers 1-40 indicate localities as listed in the record table. The shaded central region and shaded axis line delimit areas referred to in the text.



Map 3: Temperature data and collecting sites, Black Hills.

Isotherms of July temperatures in degrees F., encircled. Data as legended by the star locate the boreal center of this ecogeography. The numbers 1-40, and the shaded central region and shaded axis line refer as in maps 1-2, to tabulated collecting sites and to areas discussed in the text.

The number legend on maps 1-3 keys the location of collecting sites as numbered and listed in the table of records; map 1 orients these records to the road network, map 2 to regional precipitation, and map 3 to temperature data.

The table of records, when studied in conjunction with the maps and photographs, will show character distributions inviting closer attention.

NOTES SUPPLEMENTING THE RECORD TABLE

From field data of 1,000 specimens three points have been emphasized by tabulation, these being: 1) SITE LOCATION (charted on the maps); 2) SIZE OF SAMPLES from each site; and 3) PERCENTAGE OF "ATLANTIS" INDIVIDUALS (% "A"), *i. e.*, those with characters of blackish disk and silver spots, this % "A" being the point to note especially, in context with sample size suggesting degree of reliability and with local ecogeographic factors next described. Omitted data seem of no immediate concern but are available to interested persons, recorded for each series in GREY's card file of *Speyeria*, viz: ALTITUDE, which does not correlate especially with population structure here, for reasons noted later; SEX PERCENTAGES — there seems to be no hint of sex-linkage except in the well-known characters of vein scaling, wing shape and pattern nuances; DATES — the flight period is well-known: one brood through July and August, surviving to mid-September, peak in late July; ECOLOGICAL NOTES — these are summarized to the extent deemed necessary by a following exposition. All of these plus NOTES ON SYMPATRY, NAMES OF COLLECTORS, DEPOSITION OF MATERIAL, would take space disproportionate to assumed value, whereas the three groups data tabulated are sufficient in demonstrating the relationship which population structure of this Black Hills "*atlantis* - *lurana*" bears to the local ecogeography.

The small samples listed are included to give available information regarding dry areas where these insects are rare; in sum, they assume considerable significance. Many records had to be omitted, for reasons of various defects in data; the majority of the specimens tabulated were taken personally by MOECK and all others are from spot localities visited and surveyed by him.

SUMMARY: The "*atlantis*" individuals are concentrated centrally in the Black Hills; the corrected proportion for locations 1-2-3-4 (shaded area on maps) is nearly 69% in the 216-specimen sample. This may be compared against a percentage of 9.44% derived from the 784 examples from *all other* Black Hills collecting sites. Another indicative correlation appears when omitting from consideration the material from central areas where "A" runs high as noted: the proportion *east* of the shaded

central axis line corrects to 12.09% but drops to 3.04% *west* thereof. The western series run almost everywhere largely "pure", to "*lurana*"; the eastern set shows larger variability. There are numerous local oddities, one of the largest being the apparent rarity of "*atlantis*" in the Deadwood - Lead region, along with the scattered high percentages in a few places, for example, in the Custer State Park area, around Harney Peak, and especially the "locality 19" sample which is on the Silver Creek road north of Rochford. But this latter sample was from a boggy meadowland, reinforcing the rationale next following. The striking facts are (1) of westerly diminution of % "A" and (2) of amazing rise in a central area, both of which can be understood after taking a bird's-eye view of the Black Hills.

Ecogeography of the Black Hills

The forested Black Hills upland rises out of surrounding plains and badlands, being roughly one hundred miles north-to-south and fifty miles or so across. The Belle Fourche and Bear Lodge outliers customarily are reckoned in as part of these Hills. The region is one particularly interesting to zoogeographers, by reason of its mixed Eastern and Western biota, and to geologists because of the dome formation exposed through erosion. Toward the central part of the dome there is an interior network of Forest Service roads allowing more thorough coverage of the whole bloc than ordinarily can be managed when working in mountainous uplands. The looping main highway which circumscribes this area encompasses all major ecogeographic features of the Black Hills, defining a plot which is nowhere over twenty miles in radius, a beautifully accessible natural "laboratory".

Contrasts in plant associations are relatively slight; the rather sparse coniferous forest is fairly continuous except as interrupted by rock outcrops and grass or scrub patches. Altitudinal banding is hardly noticeable since elevations on the whole upland vary mostly only between 5,000 and 6,000 feet. A few extremes run into different zonal categories, down to 3,000 feet in fringe areas and up to over 7,000 feet on some of the south central monadnocks.

Erosion across the central dome has exposed surrounding sedimentary layers uptilted by the underlying laccolythic intrusion, viz, of sandstones, conglomerates and limestones which now appear as inward-facing escarpments. The outer sandstone rim and the interior "red valley" encircle a second principal rim, of limestone, which in turn surrounds an innermost core lying southerly on granites and northerly on schists.

By far the most important ecological feature of the Black Hills therefore is one which perhaps would not be appreciated at all except by a

sensitive field naturalist, namely, the relative impermeability of the central granitic - schistose rocks, whereby water is retained in the soil to a much larger degree than is the case in areas with the sedimentary and conglomerate tilted layers (in fact, these aquifers are quite famous, the spectacular artesian wells which have been drilled hundreds of miles away attest to their porosity). All of the surface moisture, including the small streams, passes into the rocks and disappears in the outer regions but continues through the summer months in the interior, whereby central temperatures and humidities are kept more steadily distinctive than could be appreciated from the bare figures of annual precipitation and mean temperature (which run from about 22 inches and 43° centrally, to about 16 inches and 47° around the outer rims). Interior ground-level vegetation and dwellers thereon undoubtedly experience later-lingering fogs, reduction of nocturnal-diurnal fluctuations, more cooling through sustained evaporation and other correlated effects.

It is seen in the presently described distribution that the "*atlantis*" characters dilute rapidly in samples taken when proceeding outward from the granites and schists and into the sedimentary and conglomerate rim and valley areas where temperatures average a bit higher and precipitation somewhat lower. It can be observed also that the climatic correlations, although definite, are far from precise and that it is the association with the geology, especially with the granites, which is the one most satisfying from the general viewpoint that local ecologic balances are dependent here primarily on the composition of the bedrock; all of the "large % A" samples are from granite areas. It should be emphasized again that the central area west of Deerfield Reservoir, where "*atlantis*" runs around 70% and up to over 90%, is even more boreal than climatic statistics would show: quoting Ranger WALTER RULE (personal communication) ". . . these central stream-bottom meadows once were quite boggy . . . probably the last of these wet sites left in the Hills."

[There is a recent addition to the field data: MOECK'S 1962 records of 151 individuals have been worked over for last-minute notice; percentages are 92.5% "A" in 85 examples *from the shaded central area,* and 3.0% in 66 specimens from *outside the central area,* further substantiating the pronounced segregation and further suggesting that the principal ecogeographic determinants are the ones previously deduced.]

At any event, it is clear that the "*atlantis*" and "*lurana*" of the Black Hills have a distribution pattern showing a large correlation with habitat. But before assigning any particular meaning to these data in the usual terms of evolution and adaptation it might be well to pause and reflect that these two color forms pretty surely are quite recent immigrants,

which then would lead to question whether the Black Hills were necessarily the spawning-ground of this segregation and might suggest a need for a somewhat larger accounting than would be possible within the confines of the Black Hills.

Discussion

The material seems mostly easy to sort into one category or the other, indicating segregation of quite advanced degree. There are, nevertheless, many indications of recombinations and blendings such as would mark closely parallel genetic constitutions if not outright hybridization. For example, there are the "red-silvered" individuals of varied discal shades (like specimen O, fig. 1); these occur fairly commonly (and perhaps significantly in areas harboring highly mixed populations, although rare or absent in the purer "*lurana*" colonies). It is fair to say that students familiar with general aspects of the Western variation in this complex, as next described, but lacking knowledge of the local correlatives as hereby presented, would hardly dare to guess whether the Black Hills material represents one species or two. The rift in the variation is clear, but so is the overlap.

The present *atlantis* concept is of a continentally dispersed series of geographical replacements overlapping in various degrees according with their various stages of "subspeciation" and "speciation", as roughly outlined separately by Grey (1951) and Moeck (1957). The "*atlantis*" facies characteristic in the eastern United States also is visible in the Western complex throughout the Rocky Mountain sector, carrying southwesterly to Arizona and northwesterly to Idaho, subordinate to and often submerged by redder phases but persisting until finally lost in divergent populations of the far Southwest, far West, interior Great Basin, and northwest prairies. The common circumstances everywhere in the Rocky Mountain variations are: 1) of almost complete domination by single forms with only occasional extremes suggesting taint from contact with other "subspecies"; 2) of distinctive facies in the majority of individuals along with intergrades and sharply contrasting extremes which are too numerous and too steadily distinctive to dismiss as freaks of variation; and 3) of roughly equal balances between dissimilar forms, with few or no intergrades, suggesting presence of separate species. These situations, modified in all conceivable degrees, are part of the daily experience of collectors in Colorado, New Mexico, Wyoming, and Montana, so there is no difficulty here to make out a case for the existence of a large problem in species definition, whether or not there is any agreement with our present diagnosis relating these varied popula-

tion structures to earlier confinements and migrations and to resulting clashes between intraphyletic isolates with differing capacities to blend.

On the available data there is no denying that the Black Hills situation approximates the one to be expected in the case of two reasonably discrete "species". Looking farther afield, a ready source of "*atlantis*" in this facies, with built-in tolerations of "wet" and "cold", is seen nearby in the Superior Upland population; "*lurana*" is equally easy to locate southerly, in Colorado. A good rationale would be that "*atlantis*" was the first arrival and that "*lurana*" would have had no need or inclination to go ashore here during the postglacial wetter interval when the Hills were cooler and before the Plains reached their present advanced stage of desiccation; "*lurana*" would have intruded about at the time when "*atlantis*" would have begun a retreat from peripheral drying and toward the wetter interior, as fits with the demonstrated ecological preferences.

It seems then that these insects now are being forced into close spatial contact by the further drying and warming of the Hills and that they have been in contact temporally for some hundreds if not thousands of years. The case therefore becomes that they were different "species" to begin with or that as "subspecies" they have been remarkably exempt from the supposed leveling results of intermingling and the assumed directive mechanisms of ecology, inasmuch as they appear to be clinging stubbornly to their earlier ways of life and also to their "Colorado" and "Superior Upland" facies. In either event, the present correlations of morphology and behavior with environment are significantly reduced in meaning, to the status of secondary and incidental phenomena proceeding from genetic structure earlier acquired rather than from local evolution on a "here and now" basis. This is a minor victory for the "genetic inertia" viewpoint; a larger triumph would result if these organisms could be proved "conspecific", for then the segregation would acquire still more definite perspective as a demonstration that evolutionary changes are quite slow and that wing facies tend to provide reliable indices of population movements.

The latter proposition apparently is true to this extent: specialists are agreed that most populations are best understood as products of genetic - geographic diffusion; variation at given loci usually has observable sources in a nearby or surrounding gene pool. This being the normal thing, there has been little reason to question the validity of sympatry as a test of specificity: sharp discontinuity vis-à-vis sympatres has been accepted as final proof of discreteness. The classification of *Speyeria* by DOS PASSOS and GREY (1947) represents one of the earlier breaks with that tradition, lumping dissimilar forms known to coexist or to occur juxtaposed and without reasonable barrier between, as seemed proper for emphasizing still more basic discontinuities apparent

between groups termed "species". It has appeared subsequently that other genera are plagued with similar difficulties, and it has become generally acknowledged that the species concept based on fairly uniform clinal diffusion is subject to these large exceptions introduced by collisions between partially separately evolved moieties which appear as "species" in some places, as "subspecies" in others.

Plans for future papers include further data suggestive of the extent to which local segregations may or may not be definitive of "species". For the moment, LORKOVIC's (1962) data for *Pieris* will hold the line for the view that data of sympatry, like other data, are to be sprinkled liberally with the salt of comparisons. His extensive study brings out categorical insufficiencies, in a way to suggest that taxonomy is not a proper device for indicating local degrees of racial or specific "purities". From the time of SUMNER's (1915) classical work with Deer Mice there have been many local studies of *local* problems of speciation and subspeciation which have resulted in locally defensible answers, but of many kinds, of many degrees of categorical simplicity or complexity. LORKOVIC's solution is quite straightforward: straddling the crack. Seriously, though, these many demonstrations of categorical inequalities all go to point up the need to interpret sympatry in relative terms, requiring for this purpose an expansion and cross-comparison of data sets on a scale as yet unrealized in any genus.

Far more than generally appreciated, the riddle of "species" and "subspecies", and also the even more intriguing question of evolutionary meaning in local variation and of the manner in which it may relate to time and paleogeography as well as to present local environments, all will come down to proper understanding of sympatry. In this connection *Speyeria* has virtues too often ignored, perhaps as a reaction to a bad reputation for "variability". A better standard should be availability, and richness of data afforded by numerous closely related and co-distributing "species". Who could ever hope to assemble "northern front and alpine" material to the extent needed for a comprehensive survey of Holarctic *Pieris*? The speyerians, at least, are confined to one continent and occur mostly in accessible regions, colonial and locally abundant. Even so, the needed comparative data are slow to accumulate. In "*atlantis*", for example, there are obvious gross deficiencies.

Field work is needed: in the Teton - Absoroka region of northwestern Wyoming, and also in the Laramie area in the southeastern corner of that state; on both sides of the Bear River Range in Utah and Idaho; in the foothills - prairie fringe of the east slopes of the Rocky Mountains in Montana and Alberta; in the White Mountains of Arizona; and in the Riding Mountains of Manitoba. And this names only a few of the places where need for close study is suggested by apparent segregation observed

in available material. The sad feature is that most of these places have been explored, or even heavily collected; the blame for present uncertainties must fall equally on specialists and collectors.

Investigations of continental population structures are too far beyond the capacities of individuals in single lifetimes; more should be done than is being done to encourage cooperation. By and large, collectors respond well to suggestion, as can be seen in the improved standards of data-recording which have followed upon educational campaigns in recent popular manuals and journals. It has become generally appreciated that material labeled as from, *e. g.*, "Utah" is practically valueless. The time approaches when collectors must realize that even with localities and other data properly recorded, their material may well end up with the "Black Hills" and "Oregon Territory" specimens of an earlier day, in the wastebasket. Discrimination and purpose now begin to mean far more than "specimens"; museums are clogged with uncorrelated rubble.

A reorientation of effort, toward ecogeographic analysis, would require no more energies than are expended now at random. A short article by EFF (1956) comes to mind, on a Colorado *Speyeria* distribution, which as a contribution to understanding of a local "speciation" and of local sympatry is suggestive and valuable all out of proportion to the small size of material cited, simply because the collecting was done with a careful eye on the ecogeography.

Nothing could drive home this point of the sore need for improvement in field collecting more clearly than to review the present status of "*atlantis*" in Colorado. Data sets from this one state would go very far toward elucidating the subject of environmental influence vs. earlier population movements. And there is no lack of material; in fact, "specimens" are the least of the needs; the bulky records already are a cup of tea for Tantalus. This variation is abundantly well-known and has been known for many years; what need of more specimens to prove that it exists and what point in catching more unless something can be done with them? The thing needing attention of course is to relate this variation to the places where it is found. What happens, say, in Jefferson County, where samples indicate that "*hesperis*" prevails overwhelmingly in many areas – can "*atlantis*" be found there, as established populations, merely by going to nearby cooler and wetter localities, as the Black Hills data might suggest? Surely, collectors will not pass by challenges of such fascination, once they are appreciated.

The largest fact in butterfly taxonomy today is the foundering of the species concept on the reef of segregation. The best hope for further understanding can only lie with local analyses and the ultimate integration of continentally representative data sets. The time seems ripe for a

large expansion and popularization of the needed field research, assuming that students will be easily weaned from their bemusement with "storybook taxonomy" once they realize that even the specialists are largely ignorant of "species and subspecies" and that nobody can be any wiser until more is definitely known of local population structure and of the manner in which it relates both to local ecology and to specific continental distribution patterns.

Rearing and Breeding Notes

More from curiosity as to the ease of getting ova that from any intention of starting experiments, Moeck confined a few of the dark, brightly silvered "*atlantis*" females in paper bags and did likewise with unsilvered red "*lurana*" females; all were taken Aug. 1-2, 1962, in the Black Hills, about 1 mile above Castle Creek in a locality where % "A" runs about 44. Finding eggs in the sacks, which had been deposited during the drive home, Moeck stopped in Minnesota and airmailed them to Evans. Aside from the initial separations, by color, which were maintained, particular ova were not associated with particular females. Evans's foundation stock therefore consisted of 7 "*atlantis*" and 50 "*lurana*" ova, received Aug. 6, from which 3 "*atlantis*" and 27 "*lurana*" were reared through to eclosion, proving true in facies to their respective known maternal phenotypes and showing early stage differences as described later.

After hatching, each larva ate about half its eggshell, then crawled at random for about 15 minutes, finally settling on a stem or leaf (foodplant offered: a lavender-flowered cultivated *Viola,* also a transplanted purple-flowered species from lowlands of the Patuxent River, Maryland).

The well-known snag in rearing *Speyeria* is that the overwintering tiny larvae have a habit of dying, regardless of treatment. Evans's technique, first of all, is to break the diapause. After having settled down, each larva is transferred by camel's hair brush to small bits of paper towel which have been soaked with distilled water. When the larvae crawl away they are transferred immediately to a violet leaf where they promptly go to sleep again. This disturbing has be be done repeatedly, each day and for many days, to be successful. With this material no nibbling took place until the eleventh day, after which the larvae one by one began to eat and no subsequent prodding was required.

One larva ate first on Aug. 24, another on Aug. 30; the last two did not begin to feed until Sept. 11 and 12. From the time the diapause is broken until pupation the six larval stages are passed through in a period varying between about 24 to 34 days; 2 to 7 or 8 days are spent between molts. The first molt occurs a few days after eating begins and after

a rest of about 12 hours. From the second molt on, the larvae always crawl off the fresh leaf after eating and rest nearby between meals (as they do in nature, usually hiding during the day).

Rearing cages used were tiny and then progressively larger plastic boxes, ending with screen-topped cottage cheese cups with violets kept fresh by running the stems through holes in the boxes to a jar of water below. Temperatures were maintained at room levels, between 64°-74°; humidity of course was very high within the boxes, particularly in early instars when bits of leaf were kept fresh by damp sand.

Before pupation these larvae spun a heavy mat of silk over at least one square inch of screen wire and made a sheltering curtain from bits of leaves, stems and other debris tied together with many strands of tough silk. One "*lurana*" larva was observed to make a crude cocoon beneath a large dried violet leaf, spinning silk to form a roughly spherical space between the leaf and the floor of the cottage cheese cup. Lacking room to hang vertically during pupation this larva fastened its anal prolegs to a silk pad and then was able to pupate in a nearly horizontal position. None of the other larvae were furnished with leaves large enough to form such chamber.

From the time of the fourth molt the larvae of the two varieties could be told apart by color of the double dorsal stripes: light brown in "*atlantis*"; grayish white in "*lurana*". They were otherwise quite identical in black ground color and orange of spine shafts. The pupae appeared distinctive in coloration, "*atlantis*" being darker and with less of the light brown shadings which variably mottle the wingcase area in "*lurana*". These observations were limited by the stated extent of material, which also limited breeding experiments, viz:

The single "*atlantis*" male emerged on Sept. 29, too far ahead of the first female (Oct. 26) for mating. Both sexes of "*lurana*" emerged contemporaneously with the mentioned "*atlantis*" female. Mating cages used were the gauze "picnic parasols" (as sold to keep flies from food) which are about 20 inches square, 16 inches high. The butterflies were fed from pieces of wet sponge sprinkled with granulated sugar and inserted in vials with attached stiff wire handles, facilitating movement to different locations within the cages.

At the time when the first female "*lurana*" emerged, on Oct. 20, a large male of similar color was still flying vigorously in a mating cage (this male, which emerged Oct. 11, was the only one out of several males confined, to master the art of hovering without colliding with sides of the cage). This pair, identified as male #5 and female #5, were nearly identical in facies aside from the usual sexual nuances and the trifle of silver in the female submarginal lunules. When this female

was introduced into the cage the male lit beside here and twitched his wings. Another male in the cage flew down to investigate and the #5 male drove him away; the extra male then was removed from the cage. Several times thereafter the male came close to the female and twisted his abdomen toward her but she ran away. For two days she kept her abdomen hidden between tightly folded wings whenever he approached. On the third day she was observed to protrude her genitalia. It is believed that a scent was emitted and further suspected that the large dorsal gland is a special organ for this purpose and that release of a scent by the female is an essential part of the courtship ritual. But when the male approached she again ran away and sometimes even dropped to the floor of the cage to evade pursuit. A second female "*lurana*" was introduced briefly; she behaved similarly when pursued by male #5.

It was deduced finally that perhaps the room lighting was inadequate to simulate natural conditions, and a 60-watt incandescent bulb was placed 10 inches from the cage. This was on Oct. 31. Male #5 then flew to female #5 within a few minutes after the light was turned on. He hovered some seconds below her as she hung from the top of the cage, brushing against her wingtips several times (perhaps releasing his own scent from the androconial scale pouches); then he settled beside her and initiated copulation, which lasted 95 minutes. From Nov. 1 through 8 this female laid 327 eggs while confined in a quart-sized cheese container with gauze cover, placed 2 inches below a 20-watt fluorescent bulb. About 200 eggs were placed on the gauze cover, the rest on enclosed dried violet stems and leaves. About half of these ova hatched; the rest changed color in a way to suggest fertility. This female was 11 days old, the male 20 days, at the time of mating. This stock, of known "*lurana*" parentage on both sides, is being maintained for study, and notes will be published if anything further of significance is found.

The female "*atlantis*" (#A-1) which had emerged on Oct. 26 then was placed in a cage with this same #5 "*lurana*" male. The following day she protruded her genitalia when he pursued her. Several times he nudged the tip and sides of her abdomen with his head; she would move forward an inch; he would nudge her several more times until she moved forward again. This alternate nudging and walking was repeated many times, until the male flew away after having followed her for a distance of some 12 inches. Over a period of 7 days this highly peculiar courtship was continued, sometimes under artificial light, sometimes with only daylight. The male did not twist his abdomen toward her at any time as he had been observed to do consistently with females of his own kind. EVANS believes that the male coaxes the female to release a scent which in this case may have been similar enough to his own

kind to keep his interest, but still not quite the proper mating stimulus (a keen point, this, as to which sex has the final word in selectivity). At any event, nothing came of this attempt and a further experiment was initiated, using another male.

Three males from the "*lurana*" batch differed from their brethren in being lighter orange above and light brown below. One of these, #6, had full silver and thus was somewhat intermediate in facies. When released in a cage with the "*atlantis*" female #A-1 this silvered male #6 paid court after the same fashion as male #5, although less aggressively. Copulation was not induced. The male #6 gave no regard at all to a "*lurana*" female with which he was confined for 12 days; this male was comparatively inactive, anyhow. Finally, on Nov. 14, when both male #6 and the "*lurana*" female were getting worn, artificial pairing was undertaken. Each specimen was fastened to a separate strip of yucca pith, the wings clamped with folded cardboard and bodies held by surrounding pins; the abdomens then were brought into contact by moving together the yucca strips; they were then left undisturbed in a semi-darkened room. Copulation had begun when they were checked 15 minutes later and lasted 90 minutes after they were released from the clamps. Results: 80 ova produced, all infertile.

An attempt to pair the "*atlantis*" female #A-1 with a male "*lurana*", by this same technique, was not successful; both specimens died the next day after this attempt, so the failure may have been due more to physical condition than to incompatability.

CONCLUSIONS: Aside from the obvious indication, namely, that these comparisons and experiments suggest "specific" differences, nothing else can be urged except that more work could be given profitably to this fascinating subject of mating behaviors, as well as to genetic structures since the latter remain wholly unknown. Even the former judgment, of "specificity", seems unsafe, remembering that BROWN (1961) refuses to admit unqualified separation of *Coenonympha* populations on one island which differ to the extent of having different flight periods and apparent larval differences. BROWN's mathematical treatment of wing-character comparisions provides evidence of probable gene interchange of surprisingly high frequency even though those populations at the same time are obviously discrete to some large degree. Unequivocal determination of "species" would seem equally suspect in the present instance, although the Black Hills segregates of *atlantis* exhibit a degree of independence which is certainly large. There are reasons to believe that further studies here and in other localities would be profitable since this case history of largely segregated color forms seems intimately associated with the basic problems of species.

Summary

1. This paper is the second in a series developing the viewpoint that butterfly population structures probably reflect earlier isolations and movements to an extent larger than might be supposed from the emphasis customarily given to present environments.

2. From joint study of behavior and variation of *Speyeria "atlantis"* and *"lurana"* in the Black Hills, Moeck, who took extensive population samples, discovered a large correlation with environment; the *"atlantis"* percentages increase toward the central granites and rise very high in the boggy meadows in the middle of the Hills.

3. Evans, who conducted rearing studies, reports differences in pupal color and in color of larval dorsal stripes; behavior which may indicate courtship barriers also was noted during attempted matings.

4. Grey, who is assembling comparative data of the "cluster group species" in *Speyeria,* attributes this segregation to earlier history, to collision between Superior Upland and Rocky Mountains populations, suggesting also that comparisons in other regions almost surely will reveal that there are large differences in the local extent of blending and separation. The authors agree that there can be no prospect of correcting or finalizing present tentative classifications until regionally adequate data sets become available to permit comparisons on a much larger scale.

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AN ANNOTATED SUPPLEMENT TO THE STATE LIST OF LOUISIANA BUTTERFLIES AND SKIPPERS

by Gary N. Ross and Edward N. Lambremont

Introduction

Additional collections and information gathered since the publication of an annotated Louisiana list of Rhopalocera (Lambremont, 1954) are sufficient to require the publication of a supplementary revision. Except for one report of a mass flight of *Panoquina ocola* (Edwards) by Penn (1955), another report of a new larval food plant of *Erynnis zarucco* (Lucas) by Kendall (1960), and of a sight record of *Speyeria diana* (Cramer) reported by Mather and Mather (1958), no further information on the butterflies of the state has been published.

The present supplement adds eleven new names to the state list, nine of which are new state records based on collected material.

This supplement generally follows the original format. Nomenclature usage follows Ehrlich and Ehrlich (1961), except for the Hesperiidae which follows dos Passos (1960). Only those species that constitute significant extensions of flight date, abundance, or range, or that are new state or parish records will be discussed. Many additional specimens duplicating the original information were also examined, but no further mention of these will be made at this time. Actual collection data will be given only for new state records, and for a few additional species that modify the original concept of range, flight dates, or larval food plants.

The following abbreviations are used: ETA (Edward T. Armstrong), ENL (Dr. Edward N. Lambremont), BLM (Burt L. Monroe), LDN (Dr. L. Dale Newsom), COP (Carroll O. Phillips), WPR (W. Pat Rickey), LWR (Lyman W. Roberts), GNR (Gary N. Ross), WTS (Dr. William T. Spink), JRS (James R. Stewart), LSU (Louisiana State University, Department of Entomology Insect Collections, Mrs. Joan B. Chapin, Curator). We are indebted to all of these persons (all of Baton Rouge, La. with the exception of C. O. Phillips and J. R. Stewart who are from Shreveport, La.) who contributed material which is incorporated into the collection data in the annotated list. In addition, we wish to thank the following persons who contributed specimens, or who helped in certain taxonomic identifications, and other related problems: Keith A. Arnold (Baton Rouge, La.), Dr. M. S. Blum, Dr.

Dan F. Clower, and A. D. Oliver, (Dept. of Entomology, Louisiana State University), Dr. N. W. Earle (United States Dept. of Agriculture), J. R. Heitzman (Independence, Missouri), Henry R. Hermann (New Orleans, La.), Mr. & Mrs. Bryant Mather (Jackson, Miss.), Dale K. Pollet (Gramercy, La.), Dr. Walfried J. Reinthal (Knoxville, Tenn.), and Dr. Stephen M. Russell (Louisiana State University in New Orleans).

Annotated Supplement

SATYRIDAE

Lethe portlandia portlandia (Fabricius). Although this insect had not been recorded since 1897 (Skinner), it has now been found to occur at several localities. These are: EAST BATON BOUGE: Baton Rouge, 11 Oct. 1914, 1♀ (LSU), 20 Sept. 1959, 1♂ & 22 Sept. 1959, 2♀♀ (ENL), 10 June 1960, 1♀ (LSU); IBERIA: Avery Island, 5 July 1958, 1♂ (GNR); WEST FELICIANA: Bains, 29 April 1961, 2♂♂, 2♀♀ (GNR), Weyanoke, 24 March 1962, 1♀ (BLM), 29 March 1962, 1♂ (GNR). This species seems to be quite local in occurrence and this is perhaps the reason for its scanty appearances. However, at Avery Island it was very abundant, flying low to the ground in the bamboo sites. At Bains, it was common in a circle of approximately 50 ft. in diameter. It did not stray from this area, but alighted on the leaves and trunks of the hardwood trees. When approached it would dart away, but would soon return to its former position.

Lethe creola (Skinner). This species was erroneously omitted from the original list, and an account of the rectification of this error is presented by Mather and Mather (1958). We feel that it is of some significance that *L. creola* has not been taken in Louisiana since its original description by Skinner (1897) from the Opelousas area. Mather and Mather (1958) reported only 9 specimens for the state of Mississippi. Flight dates were predominantly in July, August, and September. However, Dr. C. L. Remington (personal communication) has indicated that Yale University has collections of *L. creola* taken by F. R. Arnhold in Louisiana.

Euptychia cymela cymela (Cramer). The one new parish record is WEST FELICIANA.

Euptychia hermes sosybius (Fabricius). The new parish records are BEAUREGARD, DESOTO, EAST BATON ROUGE, and LAFOURCHE.

Euptychia areolata areolata (J. E. Smith). The new parish listing is BEAUREGARD.

Euptychia gemma gemma (Hübner). The new parish records are BEAUREGARD and DESOTO.

Cercyonis pegala pegala (Fabricius). The only new parish record is BEAUREGARD.

DANAIDAE

Danaus plexippus plexippus (Linné). The four new parish listings are CAMERON, EAST BATON ROUGE, LAFOURCHE, and PLAQUEMINES.

Danaus gilippus berenice (Cramer). This rare straggler was recorded previously from only four parishes and these were all in the southern part of the state. The new listings are: CADDO: Shreveport, 10 Oct. 1957, 1 (COP); Robson, 30 Oct. 1957, 1♀ (JRS); DESOTO: Pelican, 9 Nov. 1957, 1♂ (JRS).

NYMPHALIDAE

Agraulis vanillae nigrior (Linné). The one new parish record is EAST BATON ROUGE.

Euptoieta claudia claudia (Cramer). The new parish records are EAST BATON ROUGE, JEFFERSON DAVIS, and ST. JAMES.

Speyeria diana (Cramer). This species is included on the basis of a reliable sight record noted by MATHER and MATHER (1958). One female was sighted in Tallulah, MADISON Parish. This is a new name for the list, but in the authors' estimation is probably a stray from the northeast.

Chlosyne gorgone gorgone (Hübner). The trivial name *gorgone* appeared in the original list in the genus *Phyciodes*. The reference there was to *Phyciodes phaon*, of which *P. gorgone* is a synonym (Holland, 1931). *Chlosyne gorgone* therefore represents a new state record. The listings are: CADDO: Blanchard, 5 April 1958, 2♀♀ (JRS); Fluornoy, 25 May 1958, 1♂ (JRS); Shreveport, 9 March 1958, 1♂, 2 April 1958, 2♂♂ (JRS); DESOTO: Pelican, 30 May 1958, 2♂♂, 1♀ (JRS). Mr. STEWART states that all of these individuals were captured in grassy spots which were surrounded by mixed hardwood-coniferous forests. Further collecting must be done in this northwestern corner of the state to prove whether or not this species is a permanent resident.

Phyciodes phaon (Edwards). This species was originally listed as *P. gorgone* (see above) and is not a new species for the state. However, the additional parish records for *P. phaon* are BEAUREGARD and EAST BATON ROUGE.

Phyciodes tharos tharos (Drury). The one new parish is BEAUREGARD.

Phyciodes texana seminole (Edwards). This species has not been previously recorded from the state. The new records are: CADDO: Shreveport, 15 Nov. 1958, 1♂ (JRS); EAST BATON ROUGE: Baton Rouge, 17 June 1960, 1♂ (ENL), 28 June 1960, 2♂♂, 1♀ & 29 June 1960, 1♀ (WPR), 5 July 1960, 1♂, 1♀ (WPR & LWR); ST. TAMMANY: Slidel, 17 July 1956, 1♂ (GNR). This insect always was captured in or near forest cover while flying low to the ground.

Polygonia interrogationis (Fabricius). The new parish records are EAST BATON ROUGE and ST. JAMES.

Nymphalis antiopa antiopa (Linné). To the three records previous to this (two from New Orleans), one more must be added from this same locality. This specimen is: ORLEANS: New Orleans, 12 Oct. 1958, 1♀ (GNR). This individual was captured in the fall of the year at 7:30 P.M. with the temperature at 55°F. This female was flying around a spotlight on the home grounds of the senior author. Considering the fact that the other two New Orleans captures were made in the late summer and early fall, it appears that this species tends to migrate further south at that time of year.

Vanessa atalanta atalanta (Linné). The new parish records are BEAUREGARD, CAMERON, DESOTO, EAST BATON ROUGE, and SABINE.

Vanessa cardui cardui (Linné). The new parish records are EAST BATON ROUGE, POINT COUPEE and ST. TAMMANY.

Vanessa virginiensis (Drury). The one new parish record is EAST BATON ROUGE.

Mestra amymone (Ménétriès). This species is a new state record. The listings are: CADDO: Shreveport, 24 Sept. 1957, 1 & 8 Oct. 1957, 1♂ (JRS), 10 Oct. 1957, 1 (COP), 18 Oct. 1957, 2♂♂ & 2 (COP & JRS), 20 Oct. 1957, 4 (COP), 29 Oct. 1957, 1♂ & 30 Oct. 1957, 1♀ & 31 Oct. 1957, 1 & 2 Nov. 1957, 1♂ (JRS), 14 Nov. 1957, 3 (COP & JRS), 17 Nov. 1957, 1 (COP), 1♂ (JRS). Mr. Stewart reports that the majority of these 20 specimens were flying in a northeasterly direction. He states further that he and Mr. Phillips visited the site of these captures (along a grassy road) many times since their original visits but that they have not seen any additional individuals.

Limenitis astyanax (Fabricius). The new parish record is EAST BATON ROUGE.

Limenitis archippus watsoni (dos Passos). The new parish record is DESOTO.

Anaea andria (Scudder). The new parish listings are DESOTO, EAST BATON ROUGE, and WEST FELICIANA.

Asterocampa clyton clyton (Boisduval & LeConte). The new parish records are EAST BATON ROUGE and PLAQUEMINES.

Asterocampa celtis alicia (Edwards). The new parish records are EAST BATON ROUGE and ST. CHARLES.

LIBYTHEIDAE

Libythea bachmani bachmani (Kirtland). The new parish records are EAST BATON ROUGE and POINT COUPEE.

LYCAENIDAE

Atlides halesus halesus (Cramer). This beautiful, irridescent species has been reported only from Orleans Parish (Jung, 1950). The new parish records are: EAST BATON ROUGE: Baton Rouge, 15 May 1920, 1♀ & 15 Oct. 1920, 1♂ & 26 Sept. 1922, 1♂ & 6 Oct. 1922, 1♀ (LSU), 16 Oct. 1960, 1♂ & 28 Oct. 1960, 1♀ (ETA), 24 Oct. 1961, 1♀ (LSU). This species seems to be fairly common in Baton Rouge in the fall as proven by the numerous records. However, it is rather local in occurrence.

Calycopis cecrops (Fabricius). The new parish records are BEAUREGARD, EAST BATON ROUGE, PLAQUEMINES and WEST FELICIANA.

Strymon melinus melinus (Hübner). The new parish records are: BOSSIER: Curtis, 1 July 1958, larvae on corn (LSU), BEAUREGARD, EAST BATON ROUGE, LAFOURCHE, ST. CHARLES, and ST. MARTIN: Franklin, 27 April 1960, larvae on Crimson Clover (*Trifolium incarnatum*) (LSU).

Satyrium liparops liparops (Boisduval & LeConte). Only one individual was recorded previously from the state. The one new additional record is DESOTO: Pelican, 30 May 1958, 1♂ (JRS). This individual was netted while resting on a small hickory sprout (*Carya sp.*) in a forested area which consisted of hickory and Post Oak (*Quercus stellata*). LAMBREMONT (1954) reported his capture from a similar hardwood forest. Since only one individual was seen at Pelican, we still consider this species rare in the state.

Callophrys gryneus gryneus (Hübner). This is the first record of this species from the state. The data are WEST FELICIANA: Weyanoke, 29 March 1962, 1♀ (GNR). This single female was flushed from a red cedar (*Juniperus virginiana*) which is the species' larval food plant (Klots, 1951). Upon being disturbed, the individual flew a few feet into the air but returned almost immediately to relatively its same position on the branch. Although many similar trees grew in the area (a grassy, sloping field), and many trees "beat", no other individuals were seen.

Callophrys henrici turneri (Clench). This species is a new state record. The listings are WEST FELICIANA: Weyanoke, 24 March 1962, 1♂ (BLM), 29 March 1962, 1♂ (GNR). Both of the above captures were made along an old dirt road flanked by rich deciduous woods. However, Mr. MONROE's insect was captured on the wing after being disturbed from its resting place on a leaf whereas the senior author's capture was made while the insect was resting on a dead twig about 3 feet above the ground. *C. henrici* appears to be very local in Louisiana.

Callophrys niphon niphon (Hübner). This is also the first record of this species from the state. The data are: CADDO: Shreveport, 21 March 1958, 1♂ (JRS); DESOTO: Pelican, 2 April 1958, 1♂ (JRS). Mr. STEWART reports that he netted this species while it was feeding on spring cress (*Cardamine bulbosa*) and wild plum (*Prunus americana*). MATHER and MATHER (1958) also reported taking many of their specimens of this species on plum blossoms. It appears as if this species is also very restricted in the state.

Everes comyntas comyntas (Godart). The new parish records are BEAUREGARD, EAST BATON ROUGE, and WEST FELICIANA.

Celastrina argiolus pseudargiolus (Boisduval & LeConte). This insect was recorded previously from only two parishes. Now the following parishes must be added: EAST BATON ROUGE: Baton Rouge, 7 May 1960, 1♀ (LWR); WEST FELICIANA: Bains, 20 April 1961, 1♂; Tunica, 20 April 1961, 2♂♂, 1♀ (GNR); Weyanoke, 24 March 1962, 1♂ (BLM). All of these individuals were taken near forest cover.

PAPILIONIDAE

Papilio polyxenes asterias (Stoll). The new parish record is EAST BATON ROUGE.

Papilio cresphontes cresphontes (Cramer). The new parish listings are BEAUREGARD, EAST BATON ROUGE, SABINE, ST. CHARLES, and TANGIPAHOA.

Papilio glaucus glaucus (Linné). The two additional parish records are BEAUREGARD, DESOTO, LIVINGSTON, and ST. JAMES.

Papilio troilus ilioneus (J. E. Smith). The new parish records are BEAUREGARD, EAST BATON ROUGE, ST. CHARLES, TANGIPAHOA, and WEST FELICIANA.

Papilio palamedes palamedes (Drury). The new parish records are DESOTO, EAST BATON ROUGE, and SABINE.

Graphium marcellus marcellus (Cramer). This species was previously reported from only five parishes. The new listings are

IBERIA and WASHINGTON. *G. marcellus* is typically confined to the mixed coniferous-hardwood forests of the state. Thus the Washington Parish record seems logical enough; however, the record from coastal, marshy Iberia Parish would appear unusual until one recalls that the salt domes (of which Avery Island in Iberia Parish is an example and upon which *G. m. marcellus* was taken) support a mixed forest of pines and hardwoods. In addition, the larval food plant of this species, pawpaw (*Asimina triloba*), occurs on these elevated regions. Further collecting on other salt domes in the southwestern part of the state may turn up more representatives of this beautiful swallowtail.

Battus philenor philenor (Linné). The new parish records are BEAUREGARD, DESOTO, EAST BATON ROUGE, TANIPAHOA, and WEST FELICIANA.

PIERIDAE

Colias eurytheme eurytheme (Boisduval). The new parish records are BOSSIER, CAMERON, ST. JAMES, VERMILLION, and WEST FELICIANA. Specimens have now been captured in all twelve months of the year.

Colias cesonia (Stoll). Only one individual was recorded previously from the state. The additional records are: CADDO: Shreveport, 20 Oct. 1957, 1♂ and 31 Oct. 1957, 1♂ (JRS); EAST BATON ROUGE: Baton Rouge, 15 Oct. 1917, 1♂ (LSU).

Phoebis sennae eubule (Linné). The new parish listings are BEAUREGARD, CAMERON, and ST. JAMES.

Eurema daira daira (Latreille). The new parish records are EAST BATON ROUGE and ORLEANS: Orleans, 8 Nov. 1960, 1♀ (GNR). This species is common in the pinelands of the state. The Orleans Parish record is probably of a stray. On the night before the capture of this individual, a cold front passed through the area and could very likely have blown this single female from the pinelands north of Lake Pontchartrain southward into New Orleans.

Eurema mexicana (Boisduval). This is a new pierid from the state. The parish listings are: CADDO: Greenwood, 2 Nov. 1957, 1♀; Shreveport, 24 Oct. 1957, 1♂ & 30 Oct. 1957, 2♀♀ (JRS), 29 Oct. 1957, 1♀ (COP). Mr. STEWART informs us that the individuals before capture were "resting in bermuda grass, feeding on asters or flying east". The authors feel that the above records are of strays coming across the western border of the state from Texas.

Eurema nicippe nicippe (Cramer). The additional parishes are EAST BATON ROUGE and ST. CHARLES.

Eurema lisa (Boisduval & LeConte). The new parish records are BEAUREGARD and EAST BATON ROUGE.

Nathalis iole Boisduval. The two new records are EAST BATON ROUGE and WEST BATON ROUGE.

Pieris protodice protodice (Boisduval & LeConte). The new parish records are EAST BATON ROUGE, POINT COUPEE, and WEBSTER.

Ascia monuste phileta (Fabricius). This species has been greatly overlooked in the state as proven by the scanty records. The following new parishes must now be added: EAST BATON ROUGE: Baton Rouge, 24 June 1961, 2♂♂ (GNR); JEFFERSON: Grand Isle, 16 July 1929, 1♀ (LSU), 18 Feb. 1961, 4♂♂ (GNR). In Baton Rouge, this species was common in one open field on the above date. However, it was not encountered at any other area in the city. On Grand Isle it was very abundant in the salt marshes fringing the coasts. All specimens seen and captured were rather small in size and appeared as if they were newly emerged as indicated by their soft wings. Upon a return visit in June of the same year, large numbers of individuals were observed in this same vicinity of the island. This species is probably more locally abundant in the state than originally believed and reported.

HESPERIIDAE

Epargyreus clarus clarus (Cramer). The new parish records are EAST BATON ROUGE and ST. JAMES.

Goniurus proteus proteus (Linné). The new parish record is EAST BATON ROUGE.

Thorybes bathyllus (J. E. Smith). The one new parish listing is DESOTO.

Pyrgus communis communis (Grote). This very common skipper has now been recorded from EAST BATON ROUGE.

Pholisora catullus (Fabricius). This is a new species for the state. The one specimen examined is: EAST BATON ROUGE: Baton Rouge, 20 March 1918, 1♀ (LSU). Since the writing of this manuscript, KENDALL (1963) reported two males of this species in VERNON parish.

Staphylus mazans hayhurstii (Edwards). This species has been recorded only once from the state and that in one of the southern parishes (Jefferson). The new record is EAST BATON ROUGE: Baton Rouge, 17 June 1960, 1♂ (ENL & WPR).

Erynnis horatius (Scudder & Burgess). The new parish records are EAST BATON ROUGE and JEFFERSON.

Erynnis juvenalis juvenalis (Fabricius). Immature stages have now been taken in one new parish. This is EAST BATON ROUGE: Baton Rouge, 15 Sept. 1960, 25 larvae and pupae taken on water oak (*Quercus nigra*) (LSU). Also, adults have been recorded from WEST FELICIANA.

Erynnis zarucco (Lucas). This species was first recorded for Louisiana by Kendall (1960). He reported that he found several larvae feeding on Black Locust (*Robinia pseudoacacia*) in VERNON Parish. We now add EAST BATON ROUGE: Baton Rouge, 10 Nov. 1921, 1♂ (LSU); ST. LANDRY: Port Barre, 28 May 1960, 1♀ (LDN).

Ancyloxypha numitor (Fabricius). The new parish records for this common skipper are BEAUREGARD, EAST BATON ROUGE, SABINE, ST. JAMES, and VERMILLION. It is interesting to note that Drs. W. T. Spink & L. D. Newsom found the larvae of this species on cultivated rice in Vermillion Parish and thus it may constitute a pest of this important food crop. It was not determined at the time of collecting whether these larvae were feeding on the rice plants, or had fed on other grasses in the rice field and moved to the rice stalks before pupation. Numerous larvae and pupae were brought to the laboratory and these later produced many adults.

Copaeodes minima (Edwards). The new parish records are BEAUREGARD, CAMERON, DESOTO, and EAST BATON ROUGE.

Hylephila phyleus (Drury). The new parish records are ACADIA, BEAUREGARD, EAST BATON ROUGE, ST. JAMES, and ST. TAMMANY.

Atalopedes campestris (Boisduval). The new parish records are EAST BATON ROUGE, LAFAYETTE: Lafayette, 30 June 1958, larvae (WTS), and SABINE. Dr. Spink reports that on the above date he found many larvae and pupae on bermuda grass (as many as 30 per sq. ft. of soil and averaging 16 per sq. ft.). Furthermore, he noted that the larvae had ruined about 5 acres of good pasture land, and thus this species may be considered to be of limited economic importance in some areas.

Polites vibex brettus (Boisduval & LeConte). The new parish listings are BEAUREGARD, DESOTO, EAST BATON ROUGE, and ST. JAMES.

Wallengrenia otho otho (J. E. Smith). The new parish records are BEAUREGARD, DESOTO, SABINE, and ST. MARY.

Poanes yehl (Skinner). This is a new state record. The one individual is EAST BATON ROUGE: Baton Rouge, 17 June 1960, 1♀ (ENL & WPR).

Oligoria maculata (Edwards). The five specimens reported previously were all from the eastern part of the state. The two new western parish additions are BEAUREGARD and SABINE.

Lerema accius accius (J. E. Smith). This species has been recorded previously from only five parishes. The new listings are DESOTO, EAST BATON ROUGE, and ST. CHARLES. The present records show that it is fairly common in the state.

Amblyscirtes aesculapius (Fabricius) (=*textor* Hbn.). LAMBREMONT (1954) reported only one specimen from the state (a male from Jefferson Parish). The additional record is WEST FELICIANA: Weyanoke, 29 March 1962, 1♂ (GNR).

Nastra lherminieri (Latreille). This species was captured previously in only three parishes. The new listings are BEAUREGARD, DESOTO, and SABINE.

Lerodea eufala eufala (Edwards). Previously recorded from only two parishes, this species still appears to be rather scarce. The one new listing is DESOTO.

Panoquina ocola (Edwards). The new parishes are ACADIA, IBERVILLE, ORLEANS (Penn, 1955), and ST. LANDRY: Opelousas, 10 Nov. 1958, larvae (LDN & WTS). Dr. NEWSOM reports that he found abundant larvae and pupae on cultivated rice plants. Dr. SPINK reports that he also found numerous larvae and pupae on rice stubble, and that the larvae were possibly breeding on grasses in the rice fields. It might be pertinent to mention that Dr. JUDSON MCGUIRE (USDA), in a personal communication with the junior author stated that a skipper (*Nyctelius nyctelius* Latreille) was causing considerable damage to rice in the area of Jacobo, Cuba, in May 1958. Damage was heavy enough to require application of insecticides. *N. nyctelius* is very closely related to *P. ocola;* which has been collected and reported in great numbers in Louisiana (Penn, 1955). Additional data concerning the possible food plant relationships of *A. numitor, P. ocola,* and cultivated rice are needed to clarify this potentially important point. The possible spread of *N. nyctelius* into Louisiana from the adjacent state of Texas (Brownsville and San Antonio, in which it is well established (Klots, 1951)), might constitute a future hazard to the Louisiana rice-growing industry.

SUMMARY

Additional collections and nomenclatural revisions have been gathered as a supplement to an earlier published list (Lambremont, 1954) of Louisiana Rhopalocera. The total number of species names presently is

106. Based on known distributional data from bordering regions, the authors still expect at least 29 more species (mostly from the families Hesperiidae, Megathymidae and Lycaenidae) to be collected from this state.

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COENONYMPHA IN ESSEX COUNTY, NEW YORK

Last June 23, 1963, I captured a specimen of *Coenonympha tullia* here at Ray Brook (Essex County). I sent it to F. Martin Brown and he identified it as a typical specimen of *C. tullia inornata.* At his suggestion I deposited the specimen in the American Museum of Natural History in New York.

Joseph A. Keji

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THE EVOLUTION OF MELANISM IN A POPULATION OF *CATOCALA ILIA* (NOCTUIDAE)

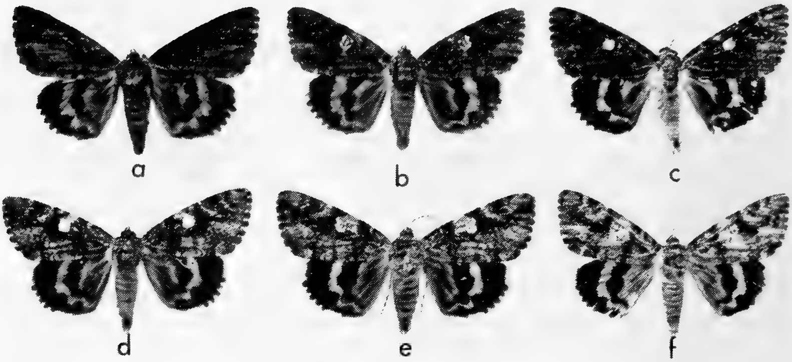
by D. F. Owen and M. S. Adams

The evolution of melanism in many species of moths is one of the most striking and rapid examples of evolution ever witnessed. Since the middle of the last century, melanic forms of geometrid and noctuid moths have spread and increased in relative frequency, and, in some areas, have almost replaced the pale 'normal' forms. In North America and in western Europe, similar, presumably related, species have been similarly effected (Owen, 1961.) All the species affected rest by day upon the trunks of trees or upon similar objects and they evidently depend upon the concealing coloration of their wings for protection from predators.

The genus *Catocala* (Noctuidae) comprises some of the best known moths that rest by day upon tree trunks. The forewings of many of the species have patterns that bear a close resemblance to the patterns on the trunks of trees, and, frequently, it is only after a moth has been accidentally disturbed and has taken flight that its presence can be detected. Many of the species of *Catocala* are extremely variable in the coloration of the forewings, while others hardly vary at all. Some species are known to have melanic forms (Forbes, 1954).

In 1961, we commenced a study of the variation in the color and pattern of the forewings of the species of *Catocala* that occur in oak-hickory woodland on the University of Michigan's Edwin S. George Reserve, Livingston County, Michigan. We obtained a large unselected sample of 1,500 specimens of about 30 species. The moths were collected at night from a white sheet above which was suspended a 100-watt mercury vapor lamp. The lamp was operated for two or three hours on every warm night throughout the summer.

Among the specimens collected were 185 *Catocala ilia* Cramer. It was immediately apparent from our sample that (1) there is much variation in the color and pattern of the forewings, and (2) melanics are relatively frequent. Accordingly, we classified the specimens into six categories; these are shown in the figure. The six categories may be described as follows (descriptions refer to forewings only):



The six coloration categories of *Catocala ilia.*
(Photograph by W. J. Graham.)

A. Melanic: forewings dark brown and all markings heavily obscured by dark scales; in some specimens reniform just discernable in outline; postmedial line black, but distinct.

B. Semimelanic: markings obscured, but clearer than in A; reniform outlined in white, with an inned ring of dark gray inside of which the color is a variable grayish-brown; subreniform relatively distinct, variable in size, generally dark, but in some specimens dark gray.

C. Semimelanic: markings as in B, but reniform solid white. Appears to be a melanic form of category D.

D. Wings normal: reniform solid white. This is form "conspicua" Worthington.

E. Wings normal: this is the type form; white and gray patches all over wings, with the lines distinct; area below reniform not contrasting with rest of wing, unlike F; reniform with gray center.

F. Wings normal: paler than E, and forewings divided into two by a broad irregular band of white or gray, which includes reniform and subreniform; reniform with gray center.

The basic distinction was between melanic and normal and in general this was quite obvious. In the analysis that follows, categories A, B, and C are regarded as melanics, and categories D, E, and F as pale or normal forms. Categories E and F intergrade considerably and may not be distinct. Categories A and B are relatively distinct from each other and from all other forms. Categories C and D are very distinct because of the solid white reniform.

The relative frequency of the six color categories is as follows:

Category:	A	B	C	D	E	F
Males:	19	35	10	7	45	56
Females:	0	0	2	1	2	1

Sixty-six of the 185 specimens were melanics and 112 were pale. There were seven others which could not be certainly classified because they were too damaged. Only 20 specimens with a white reniform were collected, but of these 12 were melanic. As with other species of *Catocala,* females rarely come to light, and hence it is not possible to say if any of the forms are sex-limited.

Melanics tend to occur earlier in the season than pale specimens. This may indicate that melanics feed up more rapidly and emerge earlier. The seasonal changes in relative frequency of melanic and pale specimens are statistically significant ($P<0.01$). The numbers according to periods are as follows:

	10-30 July	31 July-20 Aug.	21 Aug.-10 Sept.
Melanic forms (A-C):	6	26	34
Pale forms (D-F):	5	22	85

The high relative frequency of melanic *ilia* on the George Reserve in 1961 prompted us to examine earlier collections. The area has been well collected since the 1930's, and the University of Michigan Museum of Zoology has a good series from the Reserve. There are also specimens in the Michigan State University Museum, East Lansing. It can be assumed that any unusual varieties, such as melanics, would have been retained in collections. The earliest record we have of a melanic *ilia* on the Reserve is 1935, when one category B specimen was taken. In an apparently unselected sample of seven specimens taken in 1955, three are in category A, one in category E, and three in category F. These are the only records we have been able to trace of melanic *ilia* on the Reserve. J. H. NEWMAN, who has collected noctuids on the Reserve for many years, does not have a single melanic *ilia* in his collection. Elsewhere in Michigan we have found the following records of melanics: category B: Washtenaw County (adjoining Livingston County), one in 1934; Kalamazoo County, one in 1956, one in 1958; category C: Washtenaw County, one in 1934; Wayne County, one in 1948; Otsego County, one in 1960; Osceola County, one in 1951. Undoubtedly other melanic specimens exist in other collections, but

until recently they must have been relatively rare. Thus we conclude that melanic *ilia* have only recently reached their present high frequency in the area. It seems that a rapid evolutionary change has taken place similar to that recorded for certain geometrids in the same area (Owen, 1961).

Nothing is known of the selective forces that have produced this change, but, in view of the work of KETTLEWELL (1961) in the British Isles on the geometrid, *Biston betularia,* selective predation may be important. The population of *ilia* on the George Reserve in 1961 is so variable in the coloration of the forewings that one might suppose that any predator using its past experience as a means of searching for further moths would be persistently deceived. For instance, both melanic and pale "conspicua" look to the human eye quite different from the true melanics (A and perhaps B) and from normal pale moths (E and F). It is possible that *ilia* exists in a condition of relatively unstable polymorphism, and that at the present considerable changes in the relative frequency of the various forms are occurring that reflect adaptation to environmental changes. Such changes may be of a temporary nature; the melanics may begin to decrease in fitness if they become more common, and we would then expect a decrease in their relative frequency – a reversal of the present trend.

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A FURTHER STUDY OF INTERSPECIFIC HYBRIDS IN BLACK SWALLOWTAILS IN JAPAN

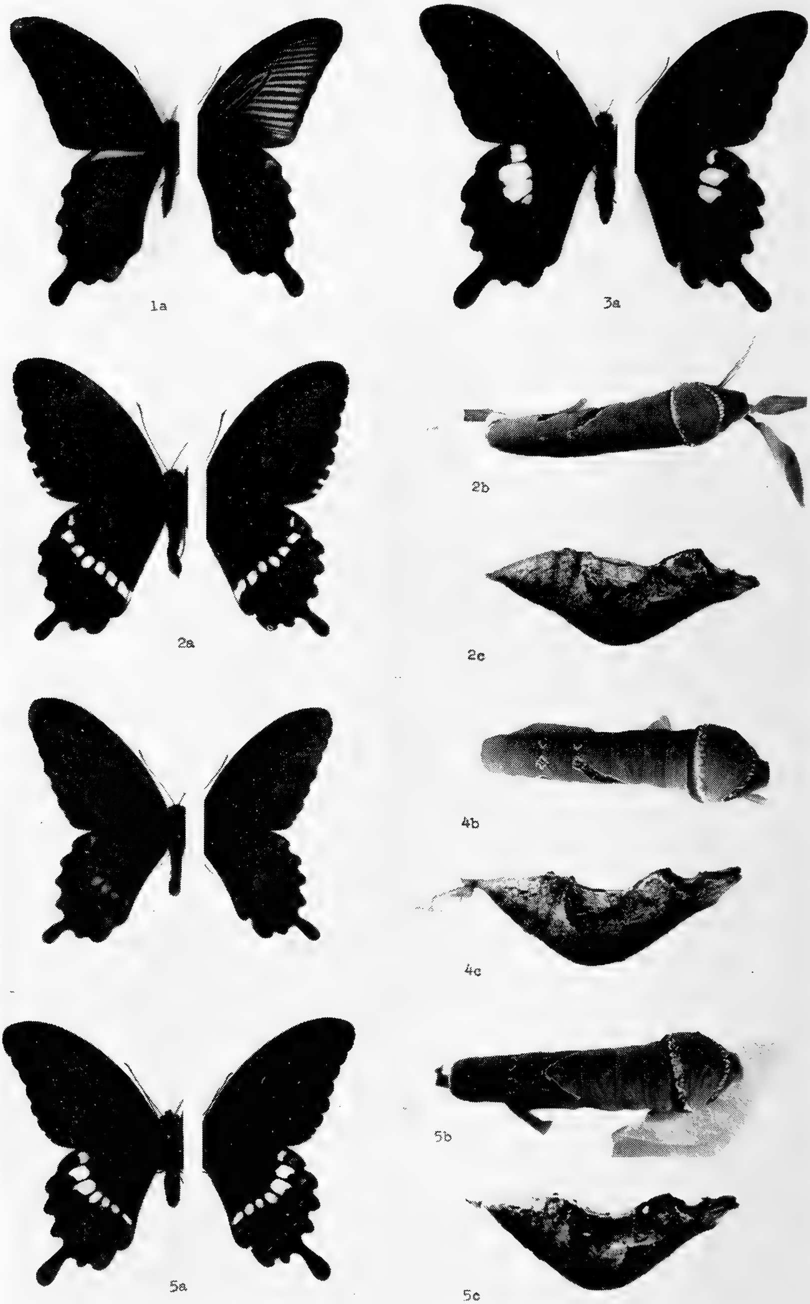
by Shigeru A. Ae

There are five species of black swallowtails in Japan which have "orange dog" type 5th instar larvae. They are *Papilio protenor demetrius* Cramer, *P. macilentus* Janson, *P. helenus nicconicolens* Butler, *P. polytes polycles* Fruhstorfer, and *P. memnon thunbergii* von Siebold. Their larvae feed on Rutaceae and their pupae also resemble each other, although their adults are easily distinguishable.

The writer has been working in interspecific hybridizations of the above black swallowtails at Nanzan University, Nagoya, Japan, since 1959 and has obtained some positive data. Some of them were previously published (Ae, 1962a, 1962b), and this paper presents the data on hybrids between *P. protenor* (Fig. 1a) and *P. polytes* (Fig. 2a), between *P. helenus* (Fig. 3a) and *P. polytes*, and between *P. helenus* and *P. protenor*.

The Cross ♀ *P. polytes* × ♂ *P. protenor*

P. protenor is common in most parts of Japan, and *P. polytes* is distributed only in a few islands of the south of Kyushu in Japan. Mr. Suguru Igarashi provided the writer many eggs and larvae of *P. polytes* in June 1960. They were the progeny of females which he collected at Kikaigajima, one of the above islands. The writer obtained 7 females and 10 males from them. They emerged in July, except 2 males which emerged in September, and were used for inter- and intraspecific matings. One of these females, O-1, which emerged on July 10, was hand-paired on July 11 to a *P. protenor* male, R-51, which was collected in Nagoya on July 9 by the writer. The duration of the copulation was about 1 hour. This female laid 20 eggs on July 12 and 13, and 19 of them hatched on July 15 and 16 at room temperature. One was killed for preservation in the 1st instar. Three were reared on Karatachi (*Poncirus trifoliata* Rafin.) and others were reared on Natsumikan (*Citrus Natsudaidai* Hayata) at the window side of the laboratory. Seven reached the 5th instar, and four pupae were obtained from them. Three of four were reared on Natsumikan and one was reared on Karatachi. All of these pupae hatched and all four adults were males. Developmental rates of the hybrids were approximately the same as with the parental species, both of which are very similar in developmental rate. The two different food plants seemed to produce no notable difference in developmental rate.


1a
3a
2b
2a
2c
4b
4c
5b
5a
5c

Larval differences between the parental species are very scant in all stages. There are distinguishable differences only in the 5th instar (Fig. 2b; Ae, 1962a, Plate 1). The stripe on the 4th and 5th abdominal segments is discontinuous at one point and the stripe on the 6th abdominal segment is discontinuous at three points in *P. polytes;* these two stripes are continuous in *P. protenor.* The stripes on the 4th and 5th segments of three of the seven hybrid larvae were discontinuous at one point, and these stripes on the other hybrid larvae were continuous (Fig. 4b). The stripes on the 6th segment of all of 7 hybrid larvae were discontinuous at the three points. The color of those stripes is brown in *P. protenor,* yellowish brown in *P. polytes,* and was brown in the hybrids.

The pupae of *P. protenor* are slenderer in general than those of *P. polytes* (Fig. 2c; Ae, 1962a, Plate 1), but they are variable. Hybrid pupae resemble *P. polytes* (Fig. 4c) and are smaller than those of *P. protenor,* but not necessarily than those of laboratory-reared *P. polytes.*

The four hybrid adults emerged from August 5 through 9. The general shapes of the wings are easily distinguishable between the species, and in shape the hybrids resemble *P. polytes.* The band which consists of 7 white patches of both sides of the hind-wing is the most prominent character of *P. polytes. P. protenor* lacks this band, but in the male it has a large slender white patch on the upper side of cell Sc-R_1 of the hindwing. In the hybrids these two characters are both expressed, although their expression is very scant, especially at the position of the patch of *P. protenor* and the cells Rs and M_1. All hybrids have more or less red scales on the basal parts of the white patches on the under side of the hindwing. These red scales are seen neither on *P. polytes* nor *P. protenor.* The white spots on the outer margin of the forwing of *P. polytes* are not present on the hybrids (Figs. 1, 2a & 3a).

The Cross ♀ *P. polytes* × ♂ *P. helenus*

P. helenus is found in many places in the central and southern parts of Japan, but it is not so common as *P. protenor.* Two females of *P. polytes,* O-5 and O-7, which emerged on July 17 and 18 respectively, were hand-

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Explanation of Plate:

Papilio protenor: 1) adult male (underside at right).
P. polytes: 2a) adult ♂ (underside at right); 2b) mature larva, dorsal; 2c) pupa, lateral.
P. helenus: 3a) adult male (underside at right).
F_1 hybrid (♀ *polytes* × ♂ *protenor*): 4a) [2nd from bottom at left] adult ♂ (underside at right); 4b) mature larva, dorsal; 4c) pupa, lateral.
F_1 hybrid (♀ *polytes* × ♂ *helenus*): 5a) adult ♂ (underside at right); 5b) mature larva, dorsal; 5c) pupa, lateral.

paired with wild males of *P. helenus,* N-25 and N-27, on July 18 and 19 respectively. The durations of copulation were both more than 1 hour. These *P. helenus* males were collected on July 6 and 18 respectively both at Ryusozan, Shizuoka Prefecture. Female O-7 did not oviposit. Female O-5 laid 86 eggs in a few days, beginning July 20. Of these 86, 67 started to develop, and embryos were well formed within 62. Larvae started to hatch July 23 at room temperature; In all, 56 1st instar larvae were obtained. Three were killed for preservation in the 1st instar. Of the remaining 53, 30 were fed on Natsumikan and 23 on Kihada (*Phellodendron amurense* Rupr.) at the window side of the laboratory. Hybrid larvae survived better on Natsumikan than on Kihada, although their developmental rates were approximately the same on both plants. Their developmental rates seem not different from the developmental rates of the parental species. Adult butterflies emerged from August 14 through 31. Sixteen adults were obtained from the larvae reared on Natsumikan and two from the larvae reared on Kihada; all eighteen were males.

Larval differences between the two parental species are very slight, as with *P. protenor* and *P. polytes* (Fig. 2b; Ae, 1962a, Plate 1). The stripe on the 4th and 5th abdominal segments in the 5th instar larva of *P. helenus* are either continuous, or discontinuous at one point; that on the 6th segment is discontinuous at three points. These discontinuous parts are narrower than on *P. polytes.* The hybrids are *helenus*-like, but the discontinuous parts show somewhat intermediate expression (Fig. 5b). The color of these stripes is dark brown in the hybrids, apparently intermediate between the deep purple of *P. helenus* and the yellowish brown of *P. polytes.*

The angle of the mid-ventral bent of the pupa of *P. helenus* is generally sharper than that of *P. polytes* (Fig. 2c; Ae, 1962, Plate 1). However, this character is variable in both species and may overlap in some individuals. The hybrids seem to be intermediate in this character (Fig. 5c). The size of the hybrid pupae was smaller than that of *P. helenus,* but not necessarily smaller than that of *P. polytes.*

In the adults of *P. polytes* and *P. helenus* the shape of the white patches of the hindwings is quite different. *P. polytes* has seven patches of almost the same size, and they are not contiguous in the Japanese subspecies. *P. helenus* has three large continuous patches on cells Sc-R_1, R_2, and M_1 and three more small continuous ones on the cell M_2, M_3, and M_4 in some individuals. Therefore, a total of 6 patches are known in *P. helenus,* and the white patch in cell Cu_2 which exists in *P. polytes* is always absent in *P. helenus* (Figs. 2a,3a). The white patches of the hybrids resemble the *P. polytes* in general, and they are very clear. However, the patches in cells R_2 and M_1 are larger than on *P. polytes* and the intervals between

patches are smaller than on *P. polytes,* Therefore, the white patches of the hybrids seem to express the character of *P. polytes*, with influence from *P. helenus* (Fig. 5a).

New Notes on Hybrids between ♀ *P. protenor* × ♂ *P. helenus*

The writer obtained 15 male hybrids between *P. protenor* and *P. helenus* in 1959 (Ae, 1962a, 1962b). In 1961, the writer obtained one more crossing by hand-pairing. On August 24 a female *P. protenor*, R-54-43 (progeny of a female collected at Midoridani, Neo-mura, Motosu-gun, Gifu Prefecture), copulated for 55 minutes with a wild *P. helenus* male, N-37, collected August 24 at the same place. This female laid many eggs, most of which hatched, and hybrid larvae were reared on Natsumikan in the screened chamber at the writer's house near Nanzan University. The first larvae pupated on September 13. Thirteen pupae were obtained within a few days. They were brown and their average length was 30.4 mm, the largest being 34.0 mm. However, several larvae continued to grow and started to pupate about one week after the pupations of the above 13 pupae. Three reached the prepupal stage but did not produce the silk girdles around their thorax. Only one succeeded in pupating. Its color was green and the length was 34.0 mm. Nine males emerged from September 24 to 27 from the thirteen brown pupae, and they were the same as the fifteen hybrids which the writer obtained in 1959. The adult body was formed within the pupal case of the green pupa on October 14. However, it failed to emerge and died. The writer broke the pupal case on October 16. Its sex was female and no white pigment was found, although the unexpanded fore and hind wings had black and red pigments.

Backcross Attempts

Most of the males of the above three kinds of hybrids looked strong. However, backcross attempts to the females of the parental species were not successful, probably because the writer had available only a few weak females of *P. protenor* and *P. helenus.*

Discusson

F_1 hybrids between *P. polytes* and *P. protenor,* between *P. polytes* and *P. helenus,* and between *P. protenor* and *P. helenus* are predominatly males. Therefore, Haldane's Rule applies to these cases, since in butterflies

the female is heterogametic. However, the data for the first crossing are too scant for a positive conclusion. These results also indicate that the above three species are not so closly related to each other as the members of the *Papilio polyxenes-machaon* group, in which almost the same numbers of females as males are produced in interspecific crossings (Clarke & Sheppard, 1953, 1955a, 1955b; Remington, 1958; Ae, 1962b).

All of the three species have white patches on their hindwings. However, the positions are different, and *P. protenor* has it only in males. The white patches of F_1 hybrids between *P. polytes* and *P. helenus* are very clear, but them of between *P. protenor* and *P. polytes* and between *P. protenor* and *P. helenus* are not clear. Therefore, white patches of *P. helenus* and *P. polytes* may be controlled by the same gene(s) with different modifiers which controlled the shapes of patches.

The fact that the F_1 hybrid female between *P. protenor* and *P. helenus* has no white pigment may indicate that the gene(s) which suppress the expression of white patch in *P. protenor* females has the same effect on the expression of white patches of *P. helenus* in the hybrids.

SUMMARY

1. One fertile mating was obtained of each of the following crosses: ♀ *P. polytes* × ♂ *P. helenus*, and ♀ *P. protenor* × ♂ *P. helenus*, and ♀ *P. protenor* × ♂ *P. helenus*, using the technique of hand-paring.

2. The egg fertility and hatchability of all the above crossings were high, and the resulting larvae developed well and with normal rates.

3. Four F_1 males from *polytes* × *protenor*, 18 F_1 males from *polytes* × *helenus*, and 9 F_1 males from *protenor* × *helenus* were obtained. No female emerged from any of the above crossings, but one female adult body was formed in its pupal case in *protenor* × *helenus*. Therefore, Haldane's Rule applies to the above three crossings.

4. Larvae and pupae of these three species resemble each other closely, and the hybrids usually show intermediate characters.

5. Sizes of the three kinds of hybrids are usually smaller than their parental species.

6. The hybrid adults also show intermediate characters between the parental species in general.

7. White patches of the hindwings of *P. polytes* and *P. helenus* may be controlled by the same gene(s) with different modifiers.

Acknowledgements

The writer wishes to express his sincere gratitude to Dr. Charles L. Remington, Department of Biology, Yale University, for reading this paper in manuscript. He is also grateful to Mr. Suguru Igarashi for providing the *P. polytes* livestock.

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A NEW NAME FOR THE PREOCCUPIED NAME *THECOPHORA* LEDERER, 1857 (NOCTUIDAE)

by Josef Moucha and Milan Chvala

We have found in the course of joint work on the orders Lepidoptera and Diptera that the generic name *Thecophora* Rondani, 1845 (Diptera, Conopidae) is an older homonym of Lederer's generic name in the family Noctuidae. The name *Thecophora* Lederer, 1857, has as far as we know no younger synonym, so, in accordance with Article 60b of the "Code", it must be substituted by a new name. We propose therefore in accordance with Article 60 of the International Code of Zoological Nomenclature, adopted by the XV International Congress of Zoology, a new name for the noctuid genus: *RILEYIANA* Moucha & Chvála, *nomen novum*. The genus is named in honor of Mr. N. D. Riley of the British Museum of Natural History, a well known specialist in the Lepidoptera.

The genus *Rileyiana* is monotypic. The species *R. fovea* (Treitschke, 1825) occurs in the southern parts of Central Europe, where it reaches the northern border of its occurrence on the territory of South Slovakia (Gregor & Povolný, 1950). It is rather rare in Hungary, but it has been found in many localities (Kovács, 1953, 1956). The male is very interesting in the fact that when flying it produces an audible sound by means of stridulation, which has been dealt with more closely, *e. g.*, by BOURGOGNE (1951: p.223, fig.244).

The name *Thecophora* has some further homonyms, to which we call attention of the competent specialists in other animal groups. The complete list is:

Thecophora Rondani, 1845, *Nuovi ann. sci. nat. Bologna* (2) 3: p.15 (Diptera, Conopidae); cited also in Rondani, 1857: p.235.

Thecophora (*emend. pro Theca* Charpentier, 1839) Agassiz, 1846, *Nomen. zool. index univ.* (Odonata).

Thecophora Lederer, 1857, *Die Noctuiden Europas*: p.99 (Noctuidae).

Thecophora Schmidt, 1870, *Spong. Atlant. Geb.*: p.50 (Porifera, Spongillidae).

For help in obtaining some information we are very indebted to Dr. G. PETERSEN of the Deutsches Entomologisches Institut in Berlin.

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NOTES ON *BOLORIA SELENE* (NYMPHALIDAE) IN THE PACIFIC NORTHWEST

by E. J. Newcomer and Wesley H. Rogers

Boloria selene Schiff. was reported by Albright (*Journ. lepid. soc.* 14: 58) as occurring at Big Summit Prairie, Crook Co., Oregon, in 1958; and by Carney (*Journ. lepid. soc.* 15: 115) from Palmer Lake, Okanogan Co., Washington, in 1961. The latter also reports that specimens had been taken by the late John C. Hopfinger and by Ruby Curtiss in Okanogan County some years ago.

The writers, together with Mrs. Fannie Jean Rogers, spent the entire day of June 1, 1962, scouting likely places for this species in the area about Palmer Lake. We found it in the wet meadow near the south-east shore of the lake, which was described by Carney, and took perhaps a dozen specimens. Then we examined several meadows to the south of Palmer Lake, around Loomis and along Sinlahekin Creek, without finding any more. Later that day, at Wesley Rogers' suggestion, we went up to Wannacut Lake. This is about 4 miles directly east of Palmer Lake and is at an elevation of about 2000 feet, as compared with 1200 feet at Palmer Lake. Here we found a likely-looking meadow at the north end of the lake, and almost immediately we found *selene* flying there. We took perhaps another dozen specimens.

Close examination of the Palmer Lake meadow had shown the presence of a violet growing down in the tall grass. This violet was also found in the meadow at Wannacut Lake. It proved to be the Northern Bog Violet (*Viola nephrophylla* Greene), which occurs in springy places from British Columbia to Quebec and south to southern California, Arizona, Colorado and Wisconsin (*vide* Abrams, L., 1951, *Illustrated flora of the Pacific States*, vol.3). This is undoubtedly the foodplant of *selene* here. The "aster" mentioned by Carney turned out to be the Philadelphia Daisy (*Erigeron philadelphicus* L.) which is found throughout the United States and Canada in moist places (Abrams, *ibid.*, vol.4). Its only significance in connection with *selene* is that it is visited by the adults. In Oregon the adults were attracted particularly to the blossoms of a *Senecio*. Later examination by Newcomer of a meadow in the Wenatchee Mountains, in Klickitat County, Washington, in which this violet was growing disclosed only *B. epithore*.

Newcomer collected at Big Summit Prairie, in Oregon, on June 10 but found no *selene*. It was taken there, however, on July 1. The elevation is

4600 feet and the season was late. He had taken it there in 1961 on both June 10 and July 1. The same *Viola nephrophylla* was found growing in a patch of an acre or two in the middle of this meadow. Several other meadows were examined in Crook County but no *selene* was found in any of them, even though some were within a mile of the known habitat. Nor could any violets be found in these other meadows. Since *selene* is a weak flier, it would probably not be found very far from its foodplant. Also, both areas have been collected later in the season, and no *selene* found, indicating that it has but a single brood.

The air-line distance between Palmer Lake and Big Summit Prairie is about 300 miles, and with the exception of the earlier findings in Okanogan County, some 50 miles south of Palmer Lake, *selene* has not been seen between the two places. It does occur in British Columbia about 25 miles north of Palmer Lake and in other places farther north. This distribution leads to speculation as to how a weak flier could occur in very restricted areas many miles apart. One can only conclude that formerly it was widely distributed in the West, but perhaps because of climatic changes it died out in most areas, leaving small colonies here and there. More thorough examination of wet meadows in which violets are growing, however, would perhaps disclose other such colonies in Oregon and Washington.

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PRESIDENTIAL ADDRESS TO THE THIRTEENTH ANNUAL MEETING OF THE LEPIDOPTERISTS' SOCIETY

LEPIDOPTERA AS SCIENTIFIC TOOLS.

Dear Fellow Members:

It is a fact that most of our knowledge of genetical mechanisms in living organisms has, up to now, been obtained by a study of *Drosophila.* This is because in these flies the comparative simplicity and large size of the chromosomes has made them particularly suitable material for laboratory investigation. Furthermore, they are easy to breed and usually disease-free. In *Drosophila* there are generally four or five sets of chromosomes containing 10-20,000 genes reacting each with the others, to express characters either behavioural, physiological or visual.

Where *Drosophila* has so miserably failed is that the survival value of visual character differences in the wild has, with few exceptions, been impossible to detect. So small are the flies that highly adaptive colour-patterning has not been divulged. Success or failure in nature must depend but little on their visual qualities. Even their life histories in the wild are little known, yet their early stages must also be subject to selection pressures.

In recent years the study of Ecological Genetics has made great advances. Using specially chosen species and particular techniques we are now able to assess population dynamics in the wild. The absence of distinctive colour and pattern in *Drosophila,* a whole dimension in nature, becomes apparent when, by contrast, we study birds, mammals and particularly the larger insects. Here they have been developed to the full by natural selection. To the student of Ecological Genetics the Lepidoptera must surely offer the very greatest advantages: on the one hand because of their highly developed patterns specialised to ensure survival by camouflage, mimicry, threat or warning coloration: on the other, because of their easy capture, easy marking and quick breeding. The colour and pattern of every lepidopteron is never fortuitous but always essential for the survival of the species.

Whenever there are two or more forms of a species flying together at the same time we can say that the species is polymorphic, and it is in such situations that we are today able to analyse some of the advantages of each form under different environmental conditions.

The Lepidoptera have in fact until recently been largely neglected for laboratory and field experiments. The reason for this is clear; namely that

in order to study them it is essential to have a knowledge of genetics, and also a more comprehensive one of the Lepidoptera species themselves, all of which differ in their life histories. This synthesis of two sciences in the same individual is but rarely found. The one is largely an academic subject learned comparatively late in life: the other is a spontaneous interest in Natural History, in particular in moths and butterflies, from earliest childhood. For this reason, amateur Lepidopterists in nearly every country, though earning their livings in different spheres, have played so important a part in recent advances in Ecological Genetics.

In Britain, the recent mapping of the frequencies of melanic forms of many species of moths, has been made possible by the voluntary help of over one hundred amateur collectors. In the Peppered Moth *Biston* (=*Amphydasis*) *betularia* alone they have provided over 20,000 records of melanic and typical forms throughout Britain. Many of these lepidopterists are not primarily interested in Science. They collect butterflies and moths for various reasons: for competition with other collectors, for æsthetic pleasure or even as a weekend escape from a nagging wife!

Since the advent of the highly efficient mercury vapour trap, first devised by HUGH ROBINSON and his brother, the competetive collecting of moths has in this country greatly diminished. The village idiot with his trap can now collect on equal terms with anyone. No longer is it necessary to have an intimate knowledge of species in order to obtain them. Nearly 150 years ago WILLIAM JOHN BURCHELL wrote this "To him who is satisfied with ammassing collections of curious objects simply for the pleasure of possessing them, such objects can afford, at best, but a childish gratification, faint and fleeting; while he who extends his view beyond the narrow field of nomenclature, beholds a boundless expanse, the exploring of which is worthy of the philosopher and the best talents of a reasonable being". However, the underlying reasons for collecting are today on a much wider plane and frequently have a more scientific interest.

Now how much have the Lepidoptera contributed so far to our knowledge of living things? For the teaching and demonstration of simple Mendelian inheritance, a number of Lepidoptera species with distinct forms showing clear-cut dominance are today regularly used in laboratories and schools. Sex-linkage was first demonstrated in *Abraxas grossulariata* f. "dohrnii" ("lacticolor") by DONCASTER. Geographical races, varying according to local conditions, geological and otherwise, have shown how intensely natural section must work. More recently we have been able to get more precise measurements of selective pressures by studying Industrial Melanism. We have shown that the black form

of *B. betularia,* the British Peppered Moth, has a 30 per cent. advantage over the light one in and around industrial centres. By this I mean that in each generation 130 of the melanic forms survive to 100 of the light ones. This was made possible by using modified marking techniques, first developed here by DOWDESWELL, FISHER and FORD, in which a dot of quick-drying cellulose colour paint is placed on the underside of a moth prior to release: four wings and say five colours, each changed according to the day, gives us twenty different markings. Subsequent recaptures may show a deficiency of one form or another.

In Britain, apart from work on Industrial Melanism this technique is being used to analyse a variety of situations: — in the Tiger Moth, *Panaxia dominula,* and its two forms, the frequencies of which have now been recorded each year by Dr. E. B. FORD for the last 26 years; in the frequency of spotting in the butterfly *Maniola jurtina;* on the forms of *Amathes glareosa* in Shetland; and in the Oak Eggar moth *Lasiocampa quercus* subspecies *callunae* in Yorkshire.

Recently I have developed a method of "marking" larvæ by feeding them on plants previously grown in water culture with radioactive isotopes. This method is the only one available for larvæ today, because of their frequent ecdyses which exclude colour marking. A known number of radioactive larvæ of *Panaxia dominula* were returned to the colony from which they had been extracted, and a proportion of radioactive imagines were subsequently recaptured. An estimate of the total imaginal population was conducted at the same time. This enabled us to say that the late-larval and pupal mortality-rate in the wild is approximately 85-95 per cent. A study of wild populations of Lepidoptera by improved marking techniques will no doubt in the next few years enable us to appreciate the fine balance of conflicting advantages and disadvantages which contribute to the survival of each form. But pattern and colour amongst the Lepidoptera, unlike *Drosophila,* must play an all-important part in their survival.

In North America the investigations of Dr. CHARLES REMINGTON and his co-workers on mimetic butterflies, on diapause, and on chromosomal counts have laid the foundations for future advances in many directions. Drs. LINCOLN and JANE BROWER *have shown* by carefully devised laboratory and field experiments that mimetic Lepdioptera gain advantage by copying distasteful species. Until this proof was forthcoming, many entomologists, particularly in France, did not believe that any such advantage could be conferred by mimicry. Dr. W. HOVANITZ has produced evidence that a sex-limited dominant gene, responsible for a colour phase difference in *Colias* species at the same time changes its behaviour pattern in nature.

In other fields the Lepidoptera have recently been responsible for advances in the knowledge – the hormonal control of growth and ecdysis by Dr. CARROLL WILLIAMS and others; the discovery that the vestibulum, present in some species of moths, may be a highly specialized organ for recognising the near-presence of bats by Dr. ASHER TREAT.

In the laboratory, by large-scale breeding experiments, work by Dr. C. A. CLARKE and Dr. PHILLIP SHEPPARD has divulged the genetic mechanisms responsible for the mimetic morphs of *Papilio dardanus,* the existence of a super-gene and the selection of a particular gene-complex (the total complement of genes present) to suit each morph according to the area of Africa its model inhabits. JOHN TURNER of Oxford is at present unravelling the series of mimetic forms in the South American species *Heliconius melpomene* and *erato,* which is likely to prove even more complex than in *Papilio dardanus* in Africa.

The biochemical knowledge of Lepidoptera is growing apace. In Britain the analysis of wing pigments is at present being studied by many: Dr. PETER BRUNET and Mr. JOHN DAVIES at Oxford; by Dr. THOMSON and others at Aberdeen and Mr. HAMSEN at Cambridge. Using gas chromatography techniques, Dr. PAUL FEENY has developed a method of analysing the chemistry of female assembling scents of several species of moths. Using different methods from those of HALLER and POTTS in their pioneer work on the scent of the Gypsy Moth, *Lymantria dispar,* we have been able to collect scent by passing the air from flasks containing assembling virgin female moths through liquid oxygen. The essence, sealed in tubes in nitrogen, has (in certain samples only) attracted males in the wild on breaking the tubes twelve weeks later.

These then are but a few of the exciting problems to which Lepidoptera, the common interest of all of us here, are contributing. There are many other lepidopterists who are contributing to science, the majority of whom have not been mentioned. If any of you feel ignored, let me assure you that this is not so. Let me tell you a true story to convince you that it is the recording of small apparently insignificant facts which is responsible for the final major conclusions.

At the beginning of the last war I had a patient who, unknown to me at the time, was a Senior Officer in Counter Espionage. In the course of conversation I told him how, before the war I had been interested in a particular moth, The Northern Arches, *Apamea exulis,* subspecies *assimilis,* which is rare and only found in Scotland. I had recently had a telephone conversation with a man I did not know who told me that he had caught two specimens in Scotland. He wished me to see them for correct identification but he regretted (and he hoped

I would not mind) that he could not possibly give me particulars of where and how he had caught them. I drove over to his home, and the first words both he and his wife said were "I do hope you understand that we cannot give you details of the locality". During tea I heard his wife tell mine, firstly that they had been married the previous year, secondly that their honeymoon had been in July at a certain remote place in Scotland, and thirdly that they never walked further than a quarter of a mile from their hotel. He showed me his collection, in which were a few specimens of the beautiful white form (f. "hospita") of *Parasemia plantaginis*. "Yes", he said, "I caught these on my honeymoon". They were boldly labelled "Loch Maree Hotel". I shall never forget his farewell remark: "Terribly sorry old man, but I cannot give you any clues, but you understand why". During our short meeting I had in fact learned the date and the year of capture, the locality within a quarter of a mile and actually even his method of capture. I had told this story to my patient, who was in Counter Espionage. I met him again after the war. He informed me that he had frequently lectured the troops by telling them this story, in order to demonstrate that it is a collection of minor apparently unrelated incidents which add up to the final realization of truth. It is the same in espionage, counter-espionage or our own spying into the private lives of Lepidoptera. Small, apparently unimportant and disconnected observations may result in an important discovery. From this each of us must learn the importance of putting on record original observations, however trifling they may seem: they may be most important to others.

In my Address today the emphasis has been on the scientific contributions of the Lepidoptera. The very title of this address specifies this. I am proud to have been your President at a moment in time when the Lepidoptera are helping to teach us so much about the fundamentals of life. Allow me, though, to make one further point. There are many Lepidopterists today to whom science is anathema; they are dismayed that their hobby is becoming more and more a tool of science. To them I would say this. "Heaven help the scientist who, using butterflies for science alone, fails to appreciate their beauty and to take advantage of the wonderful places into which they lead us. You probably get more enjoyment from these than do such men in science". In this sense I think it is wrong to divorce aesthetic pleasure from scientific fact.

The Lepidoptera, Thank God, can give satisfaction to all of us.

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ESPECIALLY FOR FIELD COLLECTORS

(Under the supervision of FRED T. THORNE, 1360 Merritt Dr., El Cajon, Calif., U.S.A.)

NOTE ON RATES OF DRYING AND RELAXATION OF SPECIMENS

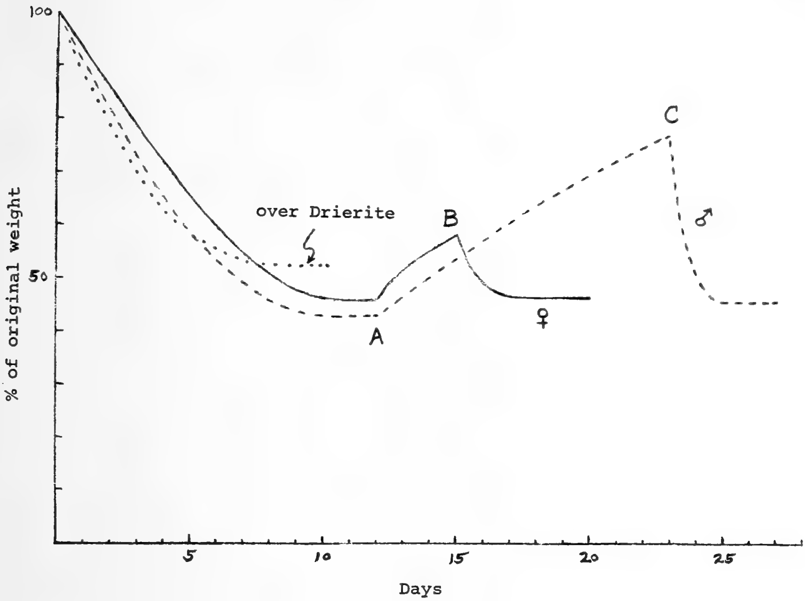
by JOHN M. KOLYER

Having long been curious as to how long butterflies take to air-dry to constant weight, how much moisture is lost, how fast it is regained during relaxation, etc., I collected the following data.

On Aug. 16, 1962, at Bristol, R. I., a mating pair of *Danaus plexippus* was captured and killed with carbon tetrachloride fumes. The fresh weights were 0.416 gram (male) and 0.492 gram (female). The specimens were stored over para-dichlorobenzene crystals (to repel pests) in a wooden box with loose-fitting cover. Each day they were weighed to three decimal places, and the results, as percent of original weight, were plotted (graph, p.179).

During the drying period the relative humidity (at Seekonk, Mass.) varied from about 30 to 90%, but since this is, presumably, a case of drying in which diffusion of water through the body of the insect is rate-controlling, the ambient humidity would be expected to influence the equilibrium moisture content but not greatly affect the rate of drying. By about ten days both specimens had reached constant weight (equilibrium moisture content). The male had lost 57% of its original weight, and the female had lost 54%.

At point A in the figure both specimens were placed over water (containing a little phenol) in a small, tight jar (atmosphere of 100% relative humidity) and, again, weighed daily. At point B the female was found to be relaxed sufficiently to be set and was spread and dried in the wooden box. It is notable, but familiar to all collectors, that the rate of drying after relaxation is very rapid. In a little over two days the female again had reached its constant weight, while about four days were required for the same loss of moisture during initial drying period. Probably this is explained by the difference in the location of the moisture in the insect; originally, it was diffusing out from the center of the body, but during relaxation water diffuses inward so that most of it is in the outer layers (all that is required for relaxation of the wings, antennae, etc.). Then drying is rapid as diffusion from near the surface proceeds quickly.



Drying and relaxation curves (weight vs. time)

The male was subjected to 100% relative humidity up to point C. At this time the body appeared well-soaked, and the weings were stained. However, after drying (in the box as before), the specimen looked quite as it had originally. This time the rate of drying was very great, constant weight being attained in two days.

At first thought, drying might be expected to be much more rapid over a drying agent. However, the mechanism of diffusion as mentioned would require that the relative humidity not affect the rate very greatly. To test this idea, another *D. plexippus* (female, fresh weight 0.647 gram) was dried in a small jar over Drierite (granular, anhydrous calcium sulfate, an efficient desiccant), *i. e.*, in an atmosphere of nearly 0% relative humidity. About eight days were required for attainment of constant weight; this is about 80% of the time needed at about 30-90% relative humidity. There seems to be no advantage in using drying agent in practice. Drying time is not lessened very much, and in the case of the above specimen the wings were shriveled and the antennae were extremely brittle.

Although no time-points were taken for other species, weight losses (ambient humidity for five to eight days) run 45 to 65% (Table I) in most

WEIGHT LOSSES ON DRYING AT AMBIENT HUMIDITY

Species	Fresh weight (grams)	Drying time (days)	Weight loss (%)
Papilio glaucus	0.37	8	49
Papilio polyxenes (3)	0.288, 0.314, 0.349	5	58, 45, 48
Papilio troilus	0.242	5	58
Cercyonis alope	0.072	6	58
Colias eurytheme (2)	0.101, 0.097	5	52, 60
Colias eurytheme (2)	0.102, 0.097	6	63, 65
Vanessa atalanta	0.286	5	57
Limenitis archippus	0.160	6	64
Phyciodes tharos	0.049	6	65

cases. Smaller species (not in table, which includes only a few of the weight-losses noted) dried more rapidly than larger ones, as expected (and well known to any collector).

In conclusion, it would seem that under normal (not persistently very humid) summer conditions the general pattern of drying and relaxation rates as shown in the graph might be expected to apply to most butterflies.

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ARTHUR WARD LINDSEY (1894 - 1963)

by EDWARD G. VOSS

"The teacher who gives up all efforts at investigation is not likely to be an inspiration to his students," wrote A. W. LINDSEY in 1938 in an article "On Teaching Biology." A better example than LINDSEY himself

could hardly have been found to illustrate the positive corollary of that statement: The teacher with a zest for investigation *will* be an inspiration to his students. I write these largely personal words of appreciation as one of those fortunate students – apparently the only one during LINDSEY's 39-year teaching career who shared and sustained any of that particular interest of his in the Skippers (Hesperioidea) for which his name is known among the members of our Society.

ARTHUR WARD LINDSEY was born January 11, 1894, in Council Bluffs, Iowa, the son of WILLIAM ENNIS LINDSEY and ELIZABETH ELLEN AGNES PHOEBE (RANDALL) LINDSEY. He attended both high school and Morningside College (A.B. 1916; hon. Sc.D. 1946) in Sioux City. It is therefore hardly surprising that his first publication, "The Butterflies of Woodbury County" (1914), should refer to the Sioux City area. This paper, completed when he was an undergraduate, with the aid and encouragement of his Morningside mentor, THOMAS CALDERWOOD STEPHENS, closed with what is in retrospect a statement more surprising: "It was my intention to include the Skippers in this paper but the greater difficulty attending a study of this group, and the limited time which I have been able to give to the work makes it necessary to omit them for the present."

Never again were the Skippers to be neglected! Five years later (1919) he put the finishing touches on his doctoral dissertation at the State University of Iowa: "The Hesperioidea of America North of Mexico" (published in 1921), thus meeting a serious need for literature on this group of insects.

During the "last stages" of his doctoral work, he visited the Barnes Collection of North American Lepidoptera in Decatur, Illinois, and became acquainted not only with BARNES but also with the late J. H. McDUNNOUGH, who had been curator of Dr. BARNES' private collection since 1910. When Dr. McDUNNOUGH left for Ottawa in 1919, LINDSEY succeeded him as curator of the Barnes Collection. (According to GUNDER [*Ent. news* 40: 250; 1929], LINDSEY was with BARNES from April 2, 1919, to August 19, 1921.) During the nearly two and one-half years which he spent as curator, the work was "largely routine," the major research being a revision of the moth family Pterophoridae, published in Volume IV of the Barnes *Contributions* (1921). (Although BARNES is listed as co-author, the work was LINDSEY's, as pointed out in Mrs. REMINGTON's biography of BARNES, *Lepid. news* 3: 53-54; 1949.)

Why LINDSEY, after so promising a start in professional entomology, turned to a career almost entirely of college teaching, I do not know. In any event, in 1921 he joined the faculty of his *alma mater,* Morningside College, and after a year came as professor and head of zoology to

Denison University, Granville, Ohio, where he remained until his retirement from teaching in 1960. Summers, which as a graduate student he had spent with the Bureau of Entomology, USDA (1916-1918), continued to provide opportunity for non-academic employment, or field work, or in some years for service on the staff of summer stations, as in 1928 (Franz Theodore Stone Laboratory), 1932 (Rocky Mountain Biological Laboratory), and 1940 (Chesapeake Biological Laboratory).

During his first two decades at Denison, he published over a dozen papers on Hesperioidea of North and South America, major contributions including a revision of his dissertation, "The Hesperioidae of North America," (1931) in collaboration with E. L. Bell and R. C. Williams, and "A Preliminary Revision of *Hesperia*" (1942).[1] Subsequent increased responsibilities (including chairmanship of the department of biological sciences from the merger of botany and zoology in 1940 until 1954), additional work during World War II, and an increasing interest in experimental evolution, cut the time available for taxonomic research.

It was the fall of 1945 when, as a high school senior, I first met Dr. Lindsey on a visit to Denison. (He had earlier, with characteristic generosity, favored me with reprints of many of his lepidopterological papers.) The following year, as a freshman at Denison, I was put to work, as soon as Lindsey returned from a sabbatical semester in Florida, mounting moths. Thus began association with a teacher gifted both in guiding the individual and in classroom presentation. Seldom, if ever, had he previously had the opportunity to instruct an eager Denison student in such techniques, as he had deftly mastered them, as spreading, de-greasing, and making microscope preparations of Lepidoptera. But year after year his classes in evolution, genetics, embryology, and other subjects exposed countless students to his remarkable clarity and precision of expression. Toward the end of a semester of embryology, I discovered that I had taken scarcely two pages of notes; so logical and clear had his exposition been that it seemed as if embryological development *could* proceed in no other way than he had smoothly described it!

Under the leadership of Lindsey, Denison attained an enviable reputation for producing exceptionally competent pre-medical students; a recommendation from him almost invariably meant acceptance in medical school. His habits of rigorous scientific thinking and explanation were contagious, and he inspired many with the excitement of research.

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[1]Copies of the issue containing the latter (Vol.37, Arts.1-2) may be obtained at $1.00 each postpaid from the Editor, Journal of the Scientific Laboratories, Denison University, Granville, Ohio. The issue devoted to the former (Vol.26, Art.1) is in very limited supply, and its distribution (at $1.50) is now restricted to libraries.

Numerous senior honors projects of high caliber were produced by his students, although I do not happen to know of any project besides my own ("On the Classification of the Hesperiidae", *Ann. ent. soc. Amer.* 45: 246-258; 1952) on a lepidopterological subject. However, if my experience in working on higher categories in the Skippers was typical (and I have no reason to doubt that it was), he permitted his students a high degree of independence and in no way attempted to impose upon them whatever ideas he may have held. Seemingly, to many, he appeared a bit remote and aloof; yet in fact he was ever approachable and willing to counsel with students.

Certainly most of his students knew him only as an esteemed teacher, an author of textbooks (five altogether, in general zoology, evolution, and genetics), and an adviser. Some knew of his extraordinary garden of daffodils or his taste for the music of BACH. Relatively few were really aware of his international reputation as an authority on the Lepidoptera and his professional attainments. With little or no secretarial assistance or reduction in his teaching load, he served as editor ("Managing Editor") of the distinguished *Annals of the Entomological Society of America* 1945-1948, succeeding C. H. KENNEDY, whom he had aided previously as Assistant Managing Editor. He was Secretary of the Ohio Academy of Science 1941-1945 and President in 1948. One wonders what his future might have been had he continued, in 1921, to devote himself full time to taxonomic research, or had he succumbed later to offers to associate himself with a larger institution. Many are the grateful physicians, teachers, and researchers among Denison alumni whose good fortune it was that A. W. LINDSEY chose to spend his life at a small college in central Ohio, a friend and inspiration to his students. "Nothing relating to man can fail to be biological." Upon this premise, Dr. LINDSEY based his teaching and an occasional somewhat philosophical excursion – *e. g.*, his articles on "The Faith of Science" and "The Fallacy of Communism" (1948).

In 1950, he reached the decision to sell to the Carnegie Museum his *Hesperia* collection and whatever other North American material had accumulated since the disposition of his collection some 20 years before – to the same Museum. This time, he did not accumulate another collection, determining to devote what research opportunity he had to the field of evolution, especially involving *Paramecium.* A Charter Member of the Lepidopterists' Society (and a member of its original "Board of Specialists"), he finally allowed his membership to lapse. But although he was no longer actively working with Skippers, they never lost their fascination for him. Writing to me in October, 1958, as he approached retirement, he commented at some length on the work of the late Brigadier EVANS, and concluded: "EVANS, like so many taxonomists, depends too heavily on

genitalia alone. After my experience with *Erynnis afranius* I am convinced that we need more information on early stages to solve some of these problems, but I'm afraid it will be gathered very slowly. If I should some day locate in the southwest I'd like to rear some of the skippers which seem to me to be valid species even though their genitalia are similar. It may be a vain hope, however, for as I approach 65 I realize that time for field work, particularly in the mountains, is running out."

On the morning of March 8, 1963, following a bout with influenza, A. W. Lindsey died of a heart attack on a downtown street in Lancaster, Ohio, where he is survived by his second wife, the former Edith (Tolliver) McMillen (whom he married in 1955), and three stepchildren and their families. He was buried in Lancaster. He is also survived by his former wife, Mrs. Winifred (Wood) Lindsey, whom he married in 1919.

On the numerous occasions I have had during the past dozen years to meet with Denison alumni at various gatherings, it is significant that former biology majors and pre-medical students have invariably asked about Dr. Lindsey – and spoken in grateful terms of the training received at his hand. It is a deserved tribute to a great soul when his former students so universally remember him with such appreciation and affection.

The books, chapters in books, articles, notes, and reviews here listed all bear Lindsey's name (or initials) as author. In addition, without any attribution of authorship of specific articles, he served as one of the Contributing Editors for the first, second, and third editions (1938, 1947, 1958) of *Van Nostrand's Scientific Encyclopedia*.

I am grateful to Dean Parker E. Lichtenstein and librarians Miss Lois Engleman and Mrs. Walter Secor, of Denison University, for their aid in adding several titles to the bibliography and in locating for me a few publications which were not available in the University of Michigan libraries for verification of citations. I only hope that not too many titles have been overlooked in the following compilation.

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Herbarium, The University of Michigan, Ann Arbor, Mich., U. S. A.

RECENT LITERATURE ON LEPIDOPTERA

Under this heading are included abstracts of papers and books of interest to lepidopterists. The world's literature is searched systematically, and it is intended that every work on Lepidoptera published after 1946 will be noticed here. Papers of only local interest and papers from this *Journal* are listed without abstract. Readers, not in North America, interested in assisting with this very large task, are invited to write Dr. P. F. Bellinger (Dept. of Natural Sciences, San Fernando Valley State College, Northridge, Calif., U. S. A.). Abstractors' initials are as follows:

[P.B.] – P. F. Bellinger	[W.H.] – W. Hackman	[N.O.] – N. S. Obraztsov
[I.C.] – I. F. B. Common	[T.I.] – Taro Iwase	[C.R.] – C. L. Remington
[W.C.] – W. C. Cook	[J.M.] – J. Moucha	[J.T.] – J. W. Tilden
[A.D.] – A. Diakonoff	[E.M.] – E. G. Munroe	[P.V.] – P. E. L. Viette

A. GENERAL

Forbes, William T. M., "Lepidoptera of New York and neighboring states. Part III. Noctuidae." *Mem. Cornell Univ. agric. Exp. Sta.*, no.329: 433 pp., 1 pl., 290 figs. 1954. Amounts to a revision of the Noctuidae of the northeastern United States. Subfamilies, genera, and species are described and keys to all categories are given. Known larvae are briefly described and foodplants listed (there is also an index to species by foodplant). [P. B.]

Ross, Herbert H., *A textbook of entomology.* 532 pp., 434 figs. New York: John Wiley & Sons. 1948.

F. BIOLOGY AND IMMATURE STAGES

Schütze, Eduard, "Über die Lebensweise der Raupe von *Acasis* (=*Lobophora*) *appensata* Ev. (Lep. Geometridae). II. Mitteilung" [in German]. *Nachrichtenbl. bayer. Ent.*, vol.5: pp.97-100. 1956. Larva lives in rolled leaf or in web on berries of *Actaea spicata.* [P. B.]

Schultz, Victor G. M., "Neue Beiträge zur Schmetterlingskunde. Nr. 12. Eine *ab ovo*-Zucht von *Cacoecia unifasciana* Dup. (Lep. Tortricidae)" [in German]. *Zeitschr. wiener ent. Ges.*, vol.63: pp.73-80, 1 pl., 1 fig. 1952. Describes early stages & rearing; foodplant *Symphoricarpos* (new record). [P. B.]

Schwenke, Wolfgang, "Unsicherheitsfaktoren bei der Kiefernspannerprognose und Möglichkeiten ihrer Überwindung. Mit einer Ermittlung der Nadelverbrauchsnormen und kritischen Zahlen von *Bupalus piniarius* L. und *Semiothisa liturata* Cl." [in German]. *Beitr. Ent.*, vol.2: pp.189-243. 1952. Outlines refined methods of predicting damage to pine stands by these spp. Amount consumed by larvæ is determined. [P. B.]

Schwenke, Wolfgang, "Untersuchungen zum Massenwechsel der Kiefernspanner *Bupalus piniarius* L. und *Semiothisa liturata* Cl. auf vergleichend-biozönotischer Grundlage" [in German]. *Beitr. Ent.*, vol.2: pp.1-55, 12 figs. 1952. Study of populations of these spp. in pine stands, by determining numbers of pupae. Different stands are classified floristically and the populations correlated with floristic & climatic factors. [P. B.]

Schwenke, Wolfgang, "Beiträge zur Bionomie der Kiefernspanner *Bupalus piniarius* L. und *Semiothisa liturata* Cl. auf biozönotischer Grundlage" [in German]. *Beitr. Ent.*, vol.3: pp.168-206, 2 figs. 1953. Data on pupal weight, time of emergence, number of eggs laid, length of egg & larval stages, & effects of environmental factors influencing these. [P. B.]

Schwenke, Wolfgang, "Unterschungen zum Massenwechsel der Kiefernspanner *Bupalus piniarius* L. und *Semiothisa liturata* Cl. auf vergleichend-biozönotischer Grundlage. II. Über die Faktoren, die die Populationsdichteunterschiede der beiden Spannerarten in verschiedenen Kiefernwaldtypen ausserhalb einer Massenvermehrung verursachen" [in German]. *Beitr. Ent.*, vol.4: pp.388-451, 2 figs. 1954. Detailed analysis of factors limiting population size, including physical factors, parasites, & predators; mortality in each stage determined & causes described. [P. B.]

Schwenke, Wolfgang, "Vergleichende Untersuchungen über die Populationsdichte und einige sie regulierende Faktoren bei der Forleule (*Panolis flammea* Schiff.), den Kiefernspannern (*Bupalus piniarius* L. und *Semiothisa liturata* Cl.) und den Kiefernschwärmer (*Hyloicus pinastri* L.) auf des Grundlage einer Einteilung der Kiefernwälder in Waldtypen" [in German]. *Beitr. Ent.*, vol.4: pp.673-683. 1954. Comparative ecological study of 4 pine-feeding spp.; gives data on sex ratio, number of eggs, parasites & percent parasitized, & population density. [P. B.]

Schwenke, W., Über Biozönosetypen, Populationstypen und Gradozöntypen. Ein Beitrag zur biozönologischen Fundierung der Massenwechsel- Erforschung der Insekten" [in German]. *Bericht über die Hundertjahrfeier der Deutschen Entomologischen Gesellschaft*: pp.106-117, 1 fig. Berlin: Akademie-Verlag. 1957. Review of factors favoring outbreaks of destructive insects, with special reference to lepidopterous pests. [P. B.]

Schwenke, Wolfgang, "Über die räuberische Tätigkeit von *Formica rufa* L. und *Formica nigricans* Emery ausserhalb einer Insekten-Massenvermehrung (Hymenoptera: Formicidae)." [in German; English & Russian summaries]. *Beitr. Ent.*, vol.7: pp.226-246, 4 figs. 1957. Ants consumed considerable part of population of *Coleophora laricella* larvae in larches near nests. [P. B.]

Schwerdtfeger, F., "Studien über die Massenwechsel einiger Forstschädlinge. IV. Untersuchungen über den 'Eisernen Bestand' von Kiefernspanner (*Bupalus piniarius* L.), Forleule (*Panolis flammea* Schiff.) und Kiefernschwärmer (*Hyloicus pinastri* L.)" [in German]. *Zeitschr. angew. Ent.*, vol.34: pp.216-283, 23 figs. 1952. Study of the statistics of eclosion, and related phenomena, in these spp., with special reference to the "normal" populations existing between outbreak periods. Parasites and frequency of parasitization are listed. The deleterious effects of unfavorable weather are demonstrated; no definite correlation between weather and the beginning of outbreaks could be demonstrated. [P. B.]

Schwerdtfeger, F., "Zum Begriff der Populationsdynamik" [in German]. *Beitr. Ent.*, vol.6: pp.461-464. 1956. Summary of concepts & parameters in population structure & fluctuation, illustrated by population of *Bupalus piniarius*. [P. B.]

Sellier, Robert, "La viviparité chez les insectes" [in French]. *Année Biol.*, ser. 3, vol.31: pp.525-545, 5 figs. 1955. Mentions reports of viviparity in Tineidae & in alpine *Colias* & *Parnassius;* almost nothing is known about this phenomenon. [P. B.]

Semel, M., "Polyhedrosis wilt of Cabbage Looper on Long Island." *Journ. econ. Ent.*, vol.49: pp.420-421. 1956. Reports very effective control of *Trichoplusia ni* by a virus wilt. [W. C.]

Sengun, Atif, "Über die biologischen Bedeutung des Duftstoffes von *Bombyx mori* L." [in German; Turkish summary]. *Rev. Fac. Sci. Univ. Istanbul, ser. B*, vol.19: pp.281-286. 1954. Describes behavior involved in attraction of ♂ and mating, & discusses mode of action of ♀ scent. [P. B.]

Sevastopulo, D. G., "On the food-plants of Indian Geometridae and Pyralidae." *Journ. Bombay nat. Hist. Soc.*, vol.47: pp.492-498. 1948. Foodplant records, original and from literature, for some 60 spp. of Geometridae and 90 of Pyralidae. [P. B.]

Sevastopulo, D. G., "Pupation habits of African Saturniidae." *Ent. Rec. & Journ. Var.*, vol.65: pp.220-221. 1953. In spp. of *Bunaea, Lobobunaea,* & *Imbrasia,* pupation takes place in an underground cell; pupa wriggles out of extended larval skin, or remains in it if cell collapses (in loose soil). [P. B.]

Sevastopulo, D. G., "Dorsal spines on noctuid pupae." *Ent. Rec. & Journ. Var.*, vol.66: p.256. 1954. Lists some spined spp. [P. B.]

Sevastopulo, D. G., "Filed notes from East Africa.—VII." *Entomologist*, vol.87: pp.103-106. 1954. Including attraction of *Rhodogastria* spp. to *Senecio* flowers; migrations of *Glycesthes creona infida* & *Achaea thermopera;* relation between duration of larval life & adult seasonal form of *Melanitis leda africana;* existence of extra instar in ♀ larvae of Lymantriidae; courtship of *Precis clelia;* apparent distastefulness of *Rhodogastria* spp. to bats; etc. [P. B.]

Sevastopulo, D. G., "*Palpita (Margarodes) unionalis* Hübner in Uganda." *Entomologist*, vol.88: pp.165-166. 1955. Describes larva & pupa; foodplants *Jasminum* spp. [P. B.]

Sevastopulo, D. G., "*Phytometra acuta* Walker." *Entomologist*, vol.89: p.257. 1956. Notes on early stages and relationships of a recent British immigrant. [P. B.]

Sevastopulo, D. G., "The 'Slug' caterpillar, *Parasa lepida* Cr., and its control." *Journ. Bombay nat. Hist. Soc.*, vol.53: pp.741-742. 1956. Records a wasp parasite. [P. B.]

Shenefelt, Roy D., & Daniel M. Benjamin, "Insects of Wisconsin forests." *Univ. Wisc. Coll. Agric. Ext. Serv. Circ.* 500: 110 pp., 27 figs. 1955. Gives notes on biology of 92 spp. or groups of spp. of Wisconsin forest insects; included are 38 spp. of Lepidoptera. [C. R.]

Shimizu, Shigeru, "Entomology of *Bombyx mori* L. (Bombycidae)" [in Japanese]. *Shin Konchu*, vol.2, no.6: pp.19-26, 10 figs. 1949.

Sibold, Nannie V., "Granulosis of the Red-banded Leaf Roller." *Virginia Journ. Sci.*, vol.1: p.226. 1950. *Argyrotaenia velutinana.*

Silver, G. T., "Studies on the Arborvitae leaf miners in New Brunswick (Lepidoptera: Yponomeutidae and Gelechiidae)." *Canad. Ent.*, vol.89: pp.171-182, 1 fig. 1957. Describes life history & control of *Argyresthia thuiella, A. freyella, A. aureoargentella,* & *Recurvaria thujaella.* [P. B.]

Silver, G. T., "Studies on the Silver-spotted Tiger Moth, *Halisidota argentata* Pack. (Lepidoptera: Arctiidae), in British Columbia." *Canad. Ent.*, vol.90: pp.65-80, 16 figs. 1958. Detailed description of all stages & biology; records parasites. Foodplants: conifers. especially *Pseudotsuga.* [P. B.]

Singh, M. P.. & D. K. McE. Kevan, "Notes on three common British species of agrotid moth. 1. Longevity and oviposition." *Ent. Rec. & Journ. Var.*, vol.68: pp.233-235. 1956. *Triphaena pronuba, Agrotis segetum, Amathes c-nigrum.*

Šíp, V., "Škody způsobené osenicí na bramborech v r. 1944" [in Czech; Russian summary]. *Ochrana Rostlin*, vol.19/20: pp.88-90. 1948. About the danger caused by *Agrotis segetum* on potatoes in 1944. [J. M.]

Sisojević, Pelagija, "Beitrag zum Studium der Rolle der Tachinen als Regulator der Populationsdichte des Schwammspinners" [in Serbian; German summary]. *Acad. serbe Sci. XXXI, Inst. Ecol. Biogeogr.* no.4: pp.63-92, 8 figs. 1953. Precise data on large role played by tachinid parasites in regulating *Lymantria dispar* populations. [C. R.]

Skala, Hugo, "Über minierende Gelechiidæ" [in German]. *Zeitschr. wiener ent. Ges.*, vol.35: pp.115-116, 1 pl. 1950. Describes mines of 35 Gelechiidae; figures many. [P. B.]

Skala, Hugo, "Über Sackminer" [in German]. *Zeitschr. wiener ent. Ges.*, vol.35: pp.111-114, 2 pls. 1950. Gives 99 figures of larval cases or mines of *Coleophora* spp. [P. B.]

Skala, Hugo, "Einige Blattminen aus verschiedenen Kleinfalterfamilien" [in German]. *Zeitschr. wiener ent. Ges.*, vol.62: p.182, 1 pl. 1952. Describes & figures mines made by larvae of some micros (Pyralidae, Tortricidae, Glyphipterygidae, Yponomeutidae, Plutellidae). [P. B.]

Skell, Fritz, "Beitrag zur rationellen Zucht *quercus* L. (Lep. Sphing.)" [in German]. *Nachrichtenbl. bayer. Ent.*, vol.5: pp.75-78. 1956. Describes rearing. [P. B.]

Smith, Kenneth M., "Virus diseases of insects." *Discovery,* vol.11: pp.175-178, 7 figs. 1950. Popular account; pathogens of various Lepidoptera. [P. B.]

Smith, Kenneth M., "The polyhedral viruses." *Sci. Progr.,* vol.41: pp.441-417, 2 pls. 1953. Review of recent work on these parasites, mainly of Lepidoptera [P. B.]

Smith, Kenneth M., "The structure of insect virus particles." *Journ. biophys. biochem. Cytol.,* vol.2: pp.301-306, 3 pls. 1956. Parasites of various lepidopterous larvae. [P. B.]

Smith, Kenneth M., & C. F. Rivers, "Some viruses affecting insects of economic importance." *Parasitology,* vol.46: pp.235-242, 4 pls. 1956. Description of diseases of *Pieris brassicae, P. rapae, Melanchra persicariae;* list of 19 spp. of Lepidoptera with the type of virus disease known to attack each. [P. B.]

Smith, Kenneth M., R. W. G. Wyckoff, & N. Xeros, "Polyhedral diseases affecting the larvae of the Privet Hawk Moth (*Sphinx ligustri*)." *Parasitology,* vol.42: pp.287-289, 1 pl. 1953. Larvae apparently infected with two virus diseases simultaneously; polyhedra descrobed. [P. B.]

Smith, Kenneth M., & N. Xeros, "Studies on the cross-transmission of polyhedral viruses: experiments with a new virus from *Pyrameis cardui,* the Painted Lady butterfly." *Parasitology,* vol.43: pp.178-185, 6 pls. 1953. Probably two viruses involved, producing nuclear and cytoplasmic polyhedroses respectively. Successful inoculations into a variety of Macrolepidoptera, of 10 families. [P. B.]

Smith, Kenneth M., & N. Xeros, "A comparative study of different types of viruses and their capsules in the polyhedroses and granuloses of insects." *Parasitology,* vol.44: pp.400-406, 2 pls. 1954. Diseases of Lepidoptera.

Smith, Kenneth M., & N. Xeros, "Electron and light microscope studies of the development of the virus rods of insect polyhedroses." *Parasitology,* vol.44: pp.71-80, 6 pls. 1954. Mainly on diseases of *Bombyx* & *Lymantria.*

Smith, Owen J., "Western Grape Leaf Skeletonizer." *California Agriculture,* vol.9, no.8: p.7, 1 fig. 1955. Use of *Apanteles harrisinae, Sturmia harrisinae,* & an unknown virus against the larvae of *Harrisina brillians* in southern California. [W. C.]

Smith, Owen J., Paul H. Dunn. & John H. Rosenberger, "Morphology and biology of *Sturmia harrisinae* Coquillett (Diptera), a parasite of the Western Grape Leaf Skeletonizer." *Univ. Calif. Publ. Ent.,* vol.10: pp.321-357, 25 figs. 1955. Parasite of *Harrisina brillians.* [P. B.]

Smith, Ray F., D. E. Bryan, & W. W. Allen, "The relations of flights of *Colias* to larval population density." *Bull. ecol. Soc. Amer.,* vol.29: p.29. 1948. Abstract; *Colias eurytheme.*

Smith, Ray F., & T. F. Leigh, "The influence of the microenvironment on the activity of *Colias philodice eurytheme* Boisduval." *Bull. ecol. Soc. Amer.,* vol.34: p.82. 1953. Abstract.

Smith, Roger C., "Effects of high soil and air temperatures on certain alfalfa insects." *Journ. Kansas ent. Soc.* vol.29: pp.1-19, 7 figs. 1956. Experiments in liberating various alfalfa insects on the soil surface in hot sunlight, at temperatures from 120 to 150 degrees F. Time required to kill is recorded in detail. Lepidoptera considered were *Plathypena scabra, Colias philodice eurytheme, Caenurgina erechtea, Heliothis zea,* & *Loxostege similalis.* [W. C.]

Sodeyama, Eishin, "Life-history of *Iratsume orsedice* Butler (Lycaenidae)" [in Japanese]. *Shin Konchu,* vol.4, no.13: pp.29-30. 1951. Foodplant: *Hamamelis japonica.* [T. I.]

Söderberg, Erik, "*Juncus beringensis* Buch. and *J. arcticus* Willd, as hosts of *Coleophora caespititiella* Zeller" [in Swedish]. *Svensk botan. Tidskr.,* vol.45: pp.683-684. 1951.

Soffner, J., "*Sterrha* (*Ptychopoda*) *eugeniata* Mill." [in German]. *Zeitschr. wiener ent. Ges.,* vol.40: pp.291-292, 1 pl. 1955. Describes early stages & biology; foodplants: grasses, *Stellaria, Taraxacum, Sonchus.* [P. B.]

Solomon, M. E., & Betty E. Adamson, "The powers of survival of storage and domestic pests under winter conditions in Britain." *Bull. ent. Res.*, vol.46: pp.311-355, 2 pls., 4 figs. 1955. Reports on cold hardiness of many insects, including 14 Lepidoptera (Phycitidae, Galleriidae, Gelechiidae, Oecophoridae, Tineidae. [P. B.]

Sonan, Jinhaku, "On the life-history of *Boarmia selenaria* Schiff. var. *cretacea* Butler (Geometridae)" [in Japanese]. *Matsumushi*, vol.3: pp.71-75, 1 fig., 3 tables. 1949.

Speyer, Walter, *Die tierischen Schädlinge des Stein - und Schalenobstes.* 5th ed. 44 pp., 14 figs.; *Die tierischen Schädlinge des Kernobstes.* 6th ed. 84 pp., 32 figs.; *Die tierischen Schädlinge des Weinstockes, der Beerensträucher und der Erdbeere.* 5th ed. 78. pp., 24 figs. [all in German]. Leipzig: Verlag Hachmeister & Thal. 1949? Small manuals of nut-tree, fruit-tree, and berry insects, including brief biological notes on many Lepidoptera. [C. R.]

Speyer, W., "Kohlweisslings-Notizen" [in German]. *Zeitschr. Pflanzenkrankh.*, vol.62: pp.552-560, 5 figs. 1955. Gives records of flowers visited by *Pieris brassicae, P. rapae,* & *P. napi.* Notes on nature of attractant in foodplant for egg-laying ♀♀, development of ovaries, number of eggs laid, habits of larvae. Records microsporidian spores in larvae, pupae, & adults. [P. B.]

Speyer, W., "Die Bedeutung Schleswig-Holsteins für den Massenwechsel des Grossen Kohlweisslings (*Pieris brassicae* L.)" [in German]. *Faunist. Mitt. Norddeutschland,* no.7: pp.17-20. 1956. Notes on foodplants & parasites. [P. B.]

Speyer, W., "*Pieris brassicae* L. in den Dünen der Nordseeinsel Amrum" [in German]. *Zeitschr. Pflanzenkrankh.,* vol.63: pp.12-14, 3 figs. 1956. Larvae feed on *Cakile maritima* on sand dunes of North Sea island. Mortality probably heavy, from predation while larvae are crossing sand between scattered plants; pupation sites unsuitable. Population probably restored annually by immigrants. [P. B.]

Stallings, Don B., & J. R. Turner, "Notes on *Megathymus polingi* (Megathymidæ)." *Lepid. News,* vol.10: p.109. 1956.

Stamm, Karl, "Ohrwürmer als Raupenvertilger" [in German]. *Zeitschr. Lepid.*, vol.3: p.50. 1953. Earwigs apparently feeding on larvæ. [P. B.]

Stauder, Fritz, "Der Kiefernknospentriebwickler (*Evetria buoliana* Schiff.) und die durch ihn verursachten Schäden im Saarland" [in German; French summary]. *Ann. Univ. Saraviensis,* vol.4: pp.165-170, 3 pls., 1 fig. 1955. Describes damage to pines; distinguishes results of feeding of several *Evetria* spp. [P. B.]

Steffan, J. R., "Sur trois *Brachymeria* Westw. (Hym. Chalcididae) parasites de lépidoptères africains" [in French]. *Bull. Mus. nat. Hist. nat.,* Paris, vol.23: pp. 524-629, 1 fig. 1951. Describes parasites of *Platyedra gossypiella, Pyroderces simplex, Mometa zemioides, Sylepta derogata* (all on cotton); of *Sphenarches caffer;* & of *Epiphora bauhiniae.* [P. B.]

Steffan, J. R., "Note sur les espèces européenes et nord-africaines du genre *Monodontomerus* Westw. (Hym. Torymidae) et leurs hôtes" [in French]. *Bull. Mus. nat. Hist. nat.,* Paris, vol.24: pp.288-293, 2 figs. 1952. Records 1 sp. as parasite of several psychids & zygaenids, & another as hyperparasite on both Hymenoptera & Diptera in various Lepidoptera. [P. B.]

Steger, Luis, "(Lep.) *Attacus edwardsi* (White) und seine Zucht" [in German]. *Zeitschr. wiener ent. Ges.,* vol.40: pp.87-90, 1 pl. 1955. Describes rearing; figures larvae & adult. [P. B.]

Steger, Luis, "(Lep.) *Citheronia brissotii* (Boisduval), ein interessanter Südamerikaner" [in German]. *Zeitschr. wiener ent. Ges.,* vol.40: pp.124-127, 2 pls. 1955. Describes early stages & rearing (on privet); figures larvae & adults. [P. B.]

Steinhaus, Edward A., "Living insecticides." *Sci. Amer.,* vol.195, no.2: pp.96-100, 102, 104, 10 figs. 1956. History of attempts to use disease in insect control, and account of successful use of virus against *Colias* attacking alfalfa. [P. B.]

Steinhaus, Edward A., "Microbial control — the emergence of an idea. A brief history of insect pathology through the nineteenth century." *Hilgardia,* vol.26: pp.107-160, 11 figs. 1956.

Steinhaus, Edward A., "Microbial diseases of insects." *Annual Rev. Microbiol.*, vol.11: pp.165-182. 1957. Reviews recent literature on bacterial, fungal, & protozan diseases, and on use of these and of virus diseases in insect control; references to many pathogens of Lepidoptera. [P. B.]

Steinhaus, Edwa d A., "New records of insect virus diseases." *Hilgardia*, vol.26: pp.417-430, 16 figs. 1957. Includes diseases of various Lepidoptera. [P. B.]

Stephens, June M., "Disease in Codling Moth larvae produced by several strains of *Bacillus cereus*." *Canad. Journ. Zool.*, vol.30: pp.30-40, 3 figs. 1952. Disease of *Carpocapsa pomonella*, normally transmitted by feeding. [P. B.]

Steyskal, George, "Insects feeding on plants of the *Toxicodendron*-section of the genus *Rhus* (Poison Oak, Ivy, or Sumac)." *Coleopt. Bull.*, vol.5: pp.75-77. 1951. Including *Nepticula rhoifoliella*. [P. B.]

Stofberg, F. J., "Larval structure as a basis for certain identification of False Codling Moth (*Argyroploce leucotreta*, Meyr.) larvae," *Journ. ent. Soc. southern Africa*, vol.11: pp.68-75, 4 figs. 1948. Detailed description of larva, with figures of setal pattern & other characters; comparative notes on *A. peltastica*. [P. B.]

Stokoe, W. J., & G. H. T. Stovin, *The caterpillars of British moths, including the eggs, chrysalids and foodplants.* 2 vols. 408 & 381 pp., 90 & 51 pls., figs. London: Frederick Warne & Co., Ltd. 1948. See review in *Lepid. News*, vol.3: p.38.

Storck, E., "Sur les traces de Fabre" [in French]. *Bull. Soc. ent. Mulhouse*, 1947: pp.29-33, 44-49. Independent demonstration that ♂ of *Saturnia parvonia* perceives ♀ scent by means of antennae and can find her only from downwind. [P. B.]

Strojny, Wladyslaw, "Some observations on the biology of *Laspeyresia corollana* Hb. (Tortricidae)" [in Polish; English & Russian summaries]. *Bull. ent. Pologne*, vol.24: pp.147-156, 1 fig. 1956.

Strokov, V. V., "Nasekomye — pervichnye vrediteli dubov v g. Sochi i ego okrestnostakh" [in Russian; The primary injurious insects on oaks on the city of Sochi and its vicinity]. *Ent. Obozrenie*, vol.32: pp.69-75. 1952. Records & describes injury caused by some insects, 8 Lepidoptera among them. [N. O.]

Stuart, A. M., "*Ephialtes brevicornis* (Grav.) as an external parasite of the Diamond-back Moth, *Plutella maculipennis* (Curt.)." *Bull. ent. Res.*, vol.48: pp.477-488, 13 figs. 1957. Describes biology & early stages of this ichneumonid; records other hosts, including Lepidoptera of 8 families. [P. B.]

Sugi, Shigero, "Notes on larva and pupa of *Gabala argentata* Butler (Phalaenidae)" [in Japanese]. *Insect Ecology*, vol.2: pp.61-64, 1 pl. 1948. Foodplant: *Rhus javanica*. [T. I.]

Sugi, Shigero, "The life-history of *Eutelia geyeri* Felder (Phalaenidae)" [in Japanese]. *Insect Ecology*, vol.3: p.24. 1950. Foodplant: *Rhus*. [T. I.]

Sugi, Shigero, "The food-plants of *Sarrothripus revayana* Scopoli in Japan (Phalaenidae)" [in Japanese]. *Insect Ecology*, vol.3: p.56. 1951. Foodplant: *Populus* sp. [T. I.]

Sugi, Shigero, "A feeding plant of *Pagyda quinquelineata* Hering (Pyralidae)" [in Japanese]. *Insect Ecology*, vol.4, no. 11: p.74. 1952. *Callicarpa japonica* (Verbenaceae) reported. [T. I.]

Sugi, Shigero, "On some lichenophagous Acontiinae from Japan (Phalaenidae)" [in Japanese; English summary]. *Tinea*, vol.1: pp.19-21. 1953. 2 spp. of *Enispa* & 4 spp. of *Corgatha* listed. [T. I.]

Sugi, Shigero & Toshiro, "Life-history of *Hadjina biguttula* Motschulsky (Phalaenidae)" [in Japanese; English summary]. *Insect Ecology*, vol.3: pp.87-89, 3 figs. 1951. Foodplant: *Bidens frondosa* (Compositae). [T. I.]

Sugi, Toshiro, "Life-history of *Nymphalis xanthomelas* D. & S. (Nymphalidae)" [in Japanese]. *Collecting & Breeding*, vol.9: pp.234-239, 245, 2 figs.; vol.10: pp.1-6-116, 6 figs. 1947, 1948. Foodplant: *Celtis chinensis*. [T. I.]

Sugi, Toshiro, "Foodplant of *Parallelia arctotaenia* Guenée (Phalaenidae)" [in Japanese]. *Insect Ecology*, vol.2: p.64. 1948. Foodplant: *Ricinus communis*. [T. I.]

Sundby, Ragnhild, "Studies on the leaf-mining moth, *Phyllocnistis labyrinthella* Bjerk. I." *Nytt Magasin Zool.*, vol.1: pp.98-128, 15 figs. 1953. Describes all stages & biology, with comparative notes on *P. suffusella;* both feed on *Populus* spp., *P. labyrinthella* especially on *P. tremula* (not attacked by *suffusella*). [P. B.]

Swain, H. D., "The British history, distribution, & life history of *Parascotia fuliginaria*, the Waved Black Moth." *Ent. Gaz.*, vol.1: pp.186-200, 11 figs., 2 maps. 1950. Good description and figures of all stages. Larvae feed on various bracket fungi. [P. B.]

Swezey, O.. H., "Insect fauna of a coconut tree." *Proc. Hawaiian ent. Soc.*, vol.14: pp.377-378. 1952. Records *Omiodes blackburni* & *Agonoxena argaula*, with parasites reared from them, & *Decadarchis minuscula*, associated with mealy bugs on palm. [P. B.]

Symes, H., "Some observations on *Coscinia cribrum* L." *Ent. Rec. & Journ. Var.*, vol.63: pp.203-204.. 1951. Rearing experiences.

Symes, H., "Some notes on breeding *Dasychira fascelina* L." *Ent. Rec. & Journ. Var.*, vol.64: pp.42-44. 15 Feb. 1952.

Symes, H., "Observations on the larva of *Nola albula* Schiff." *Ent. Rec. & Journ. Var.*, vol.65: pp.247-249. 1953. Habits; foodplant *Rubus caesius*. [P. B.]

Symes, H., "Notes on the larva of *Apatura iris* Linn." *Ent. Rec. & Journ. Var.*, vol.66: pp.40-43. 1954.

Symes, H., "A note on the life history of *Brachionycha sphinx* Hufn." *Ent. Rec. & Journ.* Var., vol.67: pp.49-53. 1955.

Symes, H., "Notes on the maple-eating Prominents." *Ent. Rec. & Journ. Var.*, vol.67: pp.113-116. 1955. Biology & distribution of *Lophopteryx cucullina* & *Ptilophora plumigera*, in Britain. [P. B.]

Symes, H., "Notes on *Xylomiges conspicillaris*." *Ent. Rec. & Journ.* Var., vol.67: pp.250-251. 1955. Notes on rearing.

Symes, H., "Some experiences with the larva of *Apatele alni* Linn." *Ent. Rec. & Journ. Var.*, vol.67: pp.314-316. 1955.

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Tanada. Y., "An annotated list of infectious diseases of insects in Hawaii. Part II." *Proc. Hawaiian ent. Soc.*, vol.16: pp.149-155. 1956. Includes diseases of *Plutella maculipennis, Hellula undalis, Trichoplusia ni, Omiodes accepta, Pieris rapae, Blepharomastix acutangulalis, Pseudaletia unipuncta,* & *Vanessa cardui*. [P. B.]

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Taylor, J. Sneyd, "Notes on Lepidoptera in the eastern Cape Province." *Journ. ent. Soc. southern Africa,* vol.12: pp.78-95, 2 pls., 1 fig. 1949. Describes larvae (foodplants in parentheses) of the following: *Phytometra exquisita* (*Euryops spathaceus*), *Polydesma quenavadi* (*Acacia*), *Euproctis fasciata* (*Acacia*), *Gynanisa maia* (*Acacia*), *Bunaea alcinoe* (*Cussonia spicata*), *Anadiasa punctifascia* (*Acacia*), & *Bombycopsis indecora* (*Pentzia incana*). Foodplant records & notes on larvae for 41 other spp. (Papilionidae, Nymphalidae, Danaidae, Hesperiidae, Amatidae, Arctiidae, Noctuidae, Lymantriidae, Sphingidae, Striphnopterygidae, Notodontidae, Geometridae, Lasiocampidae). Adults of most spp. figured. [P. B.]

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Taylor, J. Sneyd, "Notes on Lepidoptera in the eastern Cape Province." *Journ. ent. Soc. southern Africa,* vol.16: pp.143-167, 4 pls. 1953. Foodplant records & more or less complete descriptions of early stages of 44 spp. (Lycaenidae, Arctiidae, Noctuidae, Lymantriidae, Hypsidae, Sphingidae, Notodontidae, Geometridae, Lasiocampidae, Limacodidae, Pyralididae, Pterophoridae, Tortricidae, Tineidae). Adults of most spp. figured. [P. B.]

Taylor, J. Sneyd, "An asilid predator of *Dira clytus* (L.)." *Ent. Rec. & Journ. Var.,* vol.69: pp.225-226. 1957. Fly captures south African satyrid. [P. B.]

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Teucher, G., "In welchem Entwicklungsstadium überwintert der Kiefernspanner?" [in German]. *Wald,* vol.3: pp.283-284. 1953. Biology of *Bupalus piniarius;* larvae winter in ground, changing to pupae during winter. [P. B.]

Thomann, H., "Die Gäste des Blasenstrauchs" [in German]. *Ent. Nachrichtenrbl.,* Burgdorf, vol.3: pp.128-129. 1950. Records larvae feeding on *Colutea arborescens*: *Lycaena* (*Polyommatus*) *boeticus, L. cyllarus, Colias edusa* (new foodplant record), *Laspeyresia nebritana.* Notes on biology. [P. B.]

Thomson, M. G., "Appraisal of Western Hemlock Looper infestations." *Forestry Chron.,* vol.33: pp.141-147, 1 fig. 1957. *Lambdina fiscellaria lugubrosa;* notes on biology. [P. B.]

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Turček, F.-J., "A propos de deux ennemis importants des ravageurs des glands" [in French]. *Schweiz. Zeitschr. Forstwesen*, vol.108: pp.194-196, 2 figs. 1957. *Laspeyresia splendana* larvae extracted from acorns and eaten by jays & voles. [P. B.]

Uchida, Toichi, "Ein neuer Schmarotzer des Japanischen Ringelspinners (Hym., Ichneumonidae, Cryptinae)" [in German]. *Mushi*, vol.26: pp.17-18. 1954. Describes new parasite reared from *Malacosoma neustria testacea*. [P. B.]

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Ueda, Susumu, "Some notes on the parasitism of *Iseropus attaci* (Habermehl) (Hym.: Ichn.) on the Lappet Moth, *Gastropacha quercifolia* (Linné)." *Trans. Shikoku ent. Soc.*, vol.4: pp.131-132. 1956. Reports that ♀ moth emerged, laid eggs, and survived for 2 weeks, although 47 adults of this parasite and 12 braconids emerged from larva. [P. B.]

Ueda, Susumu, "Miscellaneous notes on some Ichneumonidae of Shikoku (hymenopterous notes, VIII)." *Trans. Shikoku ent. Soc.*, vol.5: pp.62-64. 1957. Records parasites on *Psilogramma increta, Parnassius stubbendorfi, Malacosoma neustria, Trisuloides sericea, Pieris rapae,* & *Carposina niponensis*. [P. B.]

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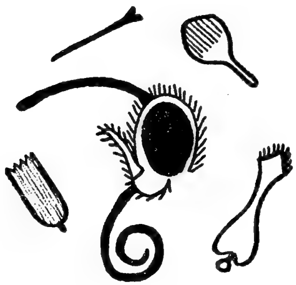

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JOURNAL OF
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PHILOTES OF CENTRAL COASTAL CALIFORNIA (LYCAENIDAE)

by ROBERT L. LANGSTON

In central coastal California, five entities of *Philotes* are known to occur: one subspecies of *P. battoides* (Behr); three subspecies of *P. enoptes* (Boisduval); and *P. sonorensis* (Felder & Felder).

TAXA

In a commonly used check-list (McDunnough, 1938), and other familiar literature, the genus *Philotes* Scudder was placed in the family Lycaenidae, subfamily Plebeiinae. Recently (Clench, 1961), this genus (along with the other so-called "Blues") has been placed in the following manner: family Lycaenidae, subfamily Lycaeninae, tribe Plebejini. The scope of this paper is neither to accept nor reject any changes in the higher taxa, but to consider only a single genus within a specified geographical area.

GEOGRAPHICAL AREA

The area considered in the present study encompasses the region in central and northern California from the southern part of Monterey County to the northern limits of Sonoma County, and inland to the Sacramento and San Joaquin Valleys. This area essentially includes both the immediate coast (Santa Lucia Range and Monterey dunes area to the North Coast Range), and the inner Coast Range (Mt. Hamilton and Diablo Ranges to the Vaca Mountains). The boundaries for this area were governed by several factors: 1) on the west by the Pacific Ocean; 2) on the east by the Central Valley where the host plants become sparse and non-existent; and 3) on the north and south

by lack of records. This last factor may seem somewhat artificial, but negative information, in this case, is important to indicate where further surveys should be made.

Although there are numerous records of the various species and subspecies of *Philotes* in southern California, the Sierra Nevada and Cascade Mountains, I have not seen specimens representing localities within several hundred miles either to the north or south of the above defined central coastal area. Collections in three major museums were examined, and all are lacking records from Sonoma County north to Oregon. There is also a gap between Monterey County and Los Angeles County from which no museum specimens have been deposited. Several collectors in California have been contacted, but no records were forthcoming for these "negative" areas.

Plant Communities

Essentially, the localities in which *Philotes* were found are in the Upper Sonoran Life Zone. Most of these areas are in the lower foothill belt, which is a grassland formation with scattered growth of various indicators, the more prominent being Coast Live Oak (*Quercus agrifolia*), Coyote Brush (*Baccharis pilularis consanguinea*), and Bush Monkey-flower (*Diplacus aurantiacus*). However, some were taken in the Redwood Transition Zone, with Madrone (*Arbutus menziesii*), Bay Tree (*Umbellularia californica*), and California Buckeye (*Aesculus californica*) in association. One subspecies of *Philotes enoptes* occurred at slightly higher elevations, only within the upper foothill woodland, indicators being Digger Pine (*Pinus sabiniana*), Chamise (*Adenostoma fasciculatum*), and California Yerba Santa (*Eriodictyon californicum*).

Host Plants

The known host plants of all except one *Philotes* within the area treated are various species of *Eriogonum* (Polygonaceae – Buckwheat family). *Philotes sonorensis* feeds on *Dudleya* and *Sedum* (Crassulaceae – Stonecrop family). Plants upon which these insects were actually found in very close association, in most cases utilizing these as the only nectar source and oviposition site, are as follows:

Eriogonum latifolium Smith
E. latifolium Smith subsp. *auriculatum* (Bentham) S. Stokes
E. latifolium Smith subsp. *nudum* (Douglas *ex* Bentham) S. Stokes
E. fasciculatum Bentham subsp. *foliolosum* (Nuttall) S. Stokes
E. parvifolium Smith
Dudleya cymosa (Lemaire) subsp. *setchellii* (Jepson) Moran

Listed below are plants in the same genera which were examined in the study area and upon which no *Philotes* have yet been found. Some of these were growing in the same plant association as those above, others were in adjacent areas or in "probable" situations. Some of these were searched for several seasons, often on the same days that specimens were taken on the "positive" plants.

Eriogonum virgatum Bentham
E. wrightii Torrey *ex* Bentham subsp. *trachygonum* (Torrey) S. Stokes
E. elongatum Bentham
E. latifolium Smith subsp. *saxicola* (Heller) S. Stokes
E. fasciculatum Bentham subsp. *polifolium* (Bentham) S. Stokes
Dudleya farinosa (Lindley) Britton & Rose
D. caespitosa (Haworth) Britton & Rose

All of the plants listed were determined at the Herbarium of the University of California, Berkeley. Reference to each of these plants will be made under the individual treatment of the insects concerned, but are listed here to give the complete taxa as identified for me by the Herbarium Staff. The plants are listed in the sequence in which they appear in Munz (1959), and the plant distributions and life zone concept were also correlated with Jepson (1925). For purposes of general discussion, *E. latifolium* (with its subspecies), *E. virgatum,* and *E. elongatum* are referred to as "herbaceous-type." *E. fasciculatum, E. parvifolium,* and *E. wrightii* with their respective subspecies are considered "shrub-type."

Abbreviations

The museums where specimens are on deposit are: California Academy of Sciences, San Francisco (CAS); California Insect Survey, Berkeley (CIS); and Los Angeles County Museum (LACM). Surnames of authors or collectors are given in full, but the initials of collectors are included only where they first appear. Where a collector's name appears followed by a museum abbreviation, it indicates specimens already on deposit in the museum at the inception of this study.

Philotes battoides bernardino Barnes & McDunnough

Philotes battoides bernardino Barnes & McDunnough. 1916, *Contr. nat. hist. Lepid. North America* 3 (2): 116, pl.11, figs.9, 11, 13; Comstock, 1927, *Butterflies California*: 192, pl.55, figs.29-31; McDunnough, 1938, *Mem. so. Calif. acad. sci.* 1: 28; Mattoni, 1954, *Bull. so. Calif. acad. sci.* 53: 164, pl.43, figs.1, 2.

Lycaena battoides var. *bernardino,* Holland, 1931, *Butterfly book,* rev. ed.: 265, pl.46, fig.37.

This Blue is well known to many southern California lepidopterists and has been in private collections and museums for many years. A description here seems unnecessary, other than to refer the reader to the illustration (Fig. 5A) and to Comstock (1927), where it is shown in color. This insect was originally described from Camp Baldy, San Bernardino Mts., California (Barnes & McDunnough, 1916), from which the name was derived.

Genitalic preparations of male specimens taken in central California (Monterey County) were made, and these have valvae that are deeply bifurcate (Fig. 1). This clearly shows that these specimens are in the *battoides* group. Preparations were also made of specimens from southern California (San Diego County), and they appear to be indistinguishable.

Variation: Based on 26 specimens from central California, there appears to be very little variation. Monterey County specimens have about the same size variation as specimens from numerous southern California localities. However, the specimens are consistently smaller than the average size of the other entities of *Philotes* in central coastal California.

Male: Forewing, average 10.02 mm. (9.2 - 10.6). Marginal fuscous band on upperside of forewing consistently wide (about 1.0 mm.). There is some variation on the upperside of the hindwing, some specimens having prominent interneural spots distinct from the marginal band. There is also a tendency for the aurora to show through in a few specimens.

Female: Forewing, average 9.54 mm. (8.5 - 10.8). The most noticeable variation is in the aurora on the upperside of the hindwing. It varies from a solid orange band 2 mm. wide in one specimen to a narrow, scalloped band in others. Most specimens are between these extremes, having distinct aurorae of the typical "*bernardino* – type" as shown in Fig. 5 A.

Distribution: COMSTOCK (1927) stated that this southern race of *P. battoides* has its home in the Sierra Madre, San Gabriel, San Bernardino, and San Jacinto Mountains of southern California. MATTONI (1954) expanded this distribution considerably; in the synoptic list at the end of the article he notes *bernardino* in California from the southern Sierras and western Mojave Desert to the coast, and in Baja California south to Cedros Island. RINDGE (1948) recorded *P. battoides* from Baja California and stated: "The Mexican specimens, especially the ones from Cedros Island, are of quite a different appearance beneath than typical *battoides*, and may constitute a new geographical

race of that species." However, MATTONI called these *bernardino*, and specimens that I have examined from the coastal foothills and as high as 3500′ in the Sierra San Pedro Martir are *bernardino*. These have been published as such by PATTERSON and POWELL (1959), along with complete locality data.

Within the area treated in the present study, *P. bernardino* has been found in only three localities. The northern records are indicated by squares on the map (Fig. 6). Records and actual specimens examined (where numbers appear) are as follows:

MONTEREY Co.: Arroyo Seco, V-22-1955, "common" (J. W. TILDEN), V-22-1955, 1 ♂, 1 ♀ (TILDEN – CAS), VI-II-1960, 1 ♀ (R. L. LANGSTON); Arroyo Seco, 4 mi. E., VI-II-1960, 15 ♂, 8 ♀♀ (LANGSTON).

SAN BENITO Co.: Flats east of Pinnacles Natl. Mon., V-16-1954, 1 ♂ (TILDEN), "At Pinnacles National Monument . . . [Ray] Stanford reports . . . *Philotes battoides* common." – quoted from THORNE (1962).

Host plants: *Philotes battoides* and all of its subspecies are found in association with various types of *Eriogonum*. *P. battoides bernardino* is most closely associated with *E. fasciculatum* and its subspecies *foliolosum* throughout the greater part of its range. *E. fasciculatum foliolosum* is one of the most abundant wild buckwheats throughout cismontane southern California. In many places this woody shrub occurs in very dense stands, and may be the dominant form of chaparral slopes. This *Eriogonum* becomes sparse, and is found in only a few favored canyons at the northern limits of its distribution in Monterey County and the Mt. Hamilton Range. The specimens I took at Arroyo Seco were on *E. fasciculatum foliolosum*[1], and I have found this plant at the Pinnacles.

For several seasons a search was made on *E. fasciculatum polifolium* in Solano County and no *P. battoides bernardino* were found. Its absence here is more likely due to the isolation of this food-plant from the more southerly areas of this insect's known range, rather than its unsuitability as a host.

Associated Lycaenidae & *Riodinidae*: In Monterey County the *Eriogonum* was highly attractive to *Plebejus acmon* (Westwood & Hewitson), which was flying in close association with *bernardino*. In many areas collected in southern California, *P. acmon* would often be present, along with *Apodemia mormo virgulti* (Behr) or *A. mormo deserti* Barnes & McDunnough, depending on locality.

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[1]Throughout this paper, the associated plants were determined from samples that I collected at the respective localities where Blues were taken by myself. Records from other collectors are not as well documented and may or may not be the same host. In most cases, the plants would probably be the same, as I have duplicated many of the general areas of the other collectors.

Synopsis: The bifurcate valvae of the male genitalia indicate this entity to be a subspecies of *P. battoides* in central California. This subspecies may be distinguished from all others in the Coast Ranges by a combination of the following characteristics: 1) the consistently wide marginal bands on upperside of both wings of male, and bold, distinct aurorae on upperside of hindwings of female; 2) the distinct black terminal line on the underside of both wings; 3) the unicolorous dark fringes on the forewings with little or no tendency for checkering; 4) male genitalia with deeply bifurcate valvae; 5) associated with shrub-type *Eriogonum;* 6) adults appear in the spring as opposed to the geographically nearest allopatric subspecies of *P. enoptes* being on the wing in the summer.

Philotes enoptes smithi Mattoni

Philotes enoptes smithi Mattoni, 1954, *Bull. so. Calif. acad. sci.* 53: 160, pl.43, figs.8, 9.

This subspecies was described by MATTONI (1954) from series collected in 1948 by him and the late CLAUDE I. SMITH, for whom this insect was named. Except for comments under "variation" below, the reader is referred to Fig. 5 B, plus the original description and its accompanying photograph.

Genitalic preparations of male specimens from the north, middle, and south localities of this insect's known range were made. All of these have valvae that are entire and subquadrate. This confirms the findings of MATTONI, placing this subspecies in the *P. enoptes* complex.

Variation: Based on 72 specimens collected from five distinct localities since the original description, plus 22 paratypes that I examined at the LACM, there is considerable variation in this subspecies. There is noticeable size variation between different populations, and there is more variation in the maculation than any other entity of *Philotes* in central coastal California. The cilia of the inner margin of the hindwing, and the abdominal hairs as noted by MATTONI will not be emphasized here or in the synopsis, because, although it is a good character for fresh individuals, the hairyness is lost or becomes not very noticeable in worn specimens, which were necessary for a complete study.

Male: Forewing, average 11.08 mm. (9.2 - 12.9). The size averaged smaller for specimens from the northern end of the range (10.56 mm.). However, size is not a good criterion, as specimens taken at the exact spot (*e.g.* holotype and paratype localities) may be considerably smaller (or larger) in different seasons. Marginal band on forewing usually at least 1 mm. wide, but in the hindwing it varies from a solid band to a

dissociation into interneural macules. There is a tendency for the aurora to appear on the upperside of the hindwing, with red scales present in a few specimens from the north end of the range, and quite extensive red-scaling present in several specimens from the south end of the range. On the underside they consistently have large, prominent macules on a light grey ground color.

Female: Forewing, average 11.23 mm. (10.1 - 12.6). Variation in size parallels the male in relation to parts of the range and different seasons. In agreement with MATTONI, the upperside of the hindwings have aurorae that are quite variable, in color from orange to red, in extent from M_2 to A as a solid band, down to a few dissociated interneural spots.

Distribution: In the original description (Mattoni, 1955) all of the paratypes were collected in Monterey County, and it was stated that *P. enoptes smithi* is apparently endemic to the Santa Lucia Mountains of central California. Additional records by several collectors, while adding a few new localities, have not extended the range either inland or to the south, and only slightly to the north. The known distribution of this insect is indicated by open circles on the map (Fig. 6). Subsequent records, some duplicating the holotype and paratype localities, are as follows:

MONTEREY CO.: Burns Creek, State Hwy. 1, VIII-20-1948, 1 ♂, 1 ♀ (C. I. SMITH—CIS), VIII-21-1954, "common," VIII-13-1955, "common" (TILDEN), VIII-28-1961, 1 ♂, 2 ♀♀ (LANGSTON) (*topotypes*); ½ mi. north of Dolan Creek, State Hwy. 1, VIII-28-1961, 7 ♂, 3 ♀♀ (LANGSTON & J. A. POWELL), VIII-24-1962, 1 ♀ (LANGSTON) (one of paratype localities); Lucia, 3 mi. S. E., VIII-6-1956, 6 ♂, 3 ♀♀ (LANGSTON); Marina Beach, dunes, VIII-24-1962, 2 ♀♀ (LANGSTON); Seaside, dunes, VII-4-1959, 9 ♂♂, 18 ♀♀ (POWELL & J. A. CHEMSAK), VIII-24-1962, 6 ♂♂, 12 ♀♀ (LANGSTON).

Three more open circles appear on the map denoting distribution as given by MATTONI (1955) that are not indicated by the detailed records above. From north to south these are Monterey, Paraiso Springs, and 4 mi. north of Gorda.

Host plants: *Philotes enoptes* and all of its subspecies are found in association with various types of *Eriogonum*. In the middle and southern parts of the range of *P. enoptes smithi*, I collected it exclusively on *Eriogonum parvifolium*. This plant is a shrub-type of buckwheat occurring in good stands on the cliffs and road-cuts along the immediate coast. In the dunes areas at the north end of this insect's known range, I also

collected it on *E. parvifolium*. However, on the dunes, the adults were also attracted to the flowers of *E. latifolium*. The latter is herbaceous and leafy only at the base. In areas to the north in Monterey and Santa Cruz Counties where *E. latifolium* was found in abundance in the absence of *E. parvifolium*, this Blue was not found.

Associated Lycaenidae & Riodinidae: In the middle and southern parts of its range, *P. enoptes smithi* was flying in association with *Plebejus acmon*. In the northern dunes areas it was also with *P. acmon* along with heavy, peak flights of *Apodemia mormo mormo* (Felder & Felder).

Synopsis: The entire, subquadrate valvae of the male genitalia indicate this entity to be a coastal subspecies of *P. enoptes* in central California. This subspecies may be distinguished from all others by a combination of the following characteristics: 1) the wide marginal band on upperside of forewings of male; 2) the faint terminal line on the underside of both wings; 3) the prominent checkering of the forewing fringe on both upper and under surfaces; 4) a light underside with large, prominent macules; 5) associated with shrub-type *Eriogonum* in the fog-belt of the immediate coast; 6) adults appear in the summer as opposed to the geographically nearest allopatric *Philotes* being on the wing in the spring.

PHILOTES ENOPTES BAYENSIS Langston, NEW SUBSPECIES

Male: Upper surface: Forewing: length 11.6 mm.; overlaid scales iridescent blue; marginal band narrow, 0.33 mm. in width; fringes white with well developed fuscous areas at vein ends, resulting in pronounced checkering, marginal length of fuscous and white of equal alternate distribution; basal area with blue and white ciliae. Hindwing: overlaid scales iridescent blue extending from above cell and R to A_2; anterior margin with fuscous extending only half way to cell and above R vein; marginal band narrow, 0.25 mm. wide; roundish interneural spots distinct from marginal band, extending from M_1 to A_1; fringes continuously white with no checkering; no trace of aurora; cilia of inner margin predominately black, intermixed with some white, up to 1 mm. in length; basal area with long, white ciliae.

Under surface: Forewing: ground light grey; all macules distinct as little suffusion, even in basal area; two small basal macules; fringes as upper surface, delineated by narrow terminal line. Hindwing: Ground light grey; macules small, but distinct as little suffusion, even in basal area; fringes white with slightly developed fuscous areas at vein ends, resulting in moderate checkering; aurora orange, well developed with cusps filling interneural areas between M^1 and A^1; cilia of inner margin and basal area white, dense, up to 1 mm. long.

Abdomen: densely covered with long, white hairscales above and short, white hairscales below; genitalia (from paratypes and topotypes) of the *P. enoptes* conformation; valvae entire and subquadrate with 21 discernable spines; processes of fultura inferior curved at tips; paired arms of gnathos slender, terminating in slightly curved points.

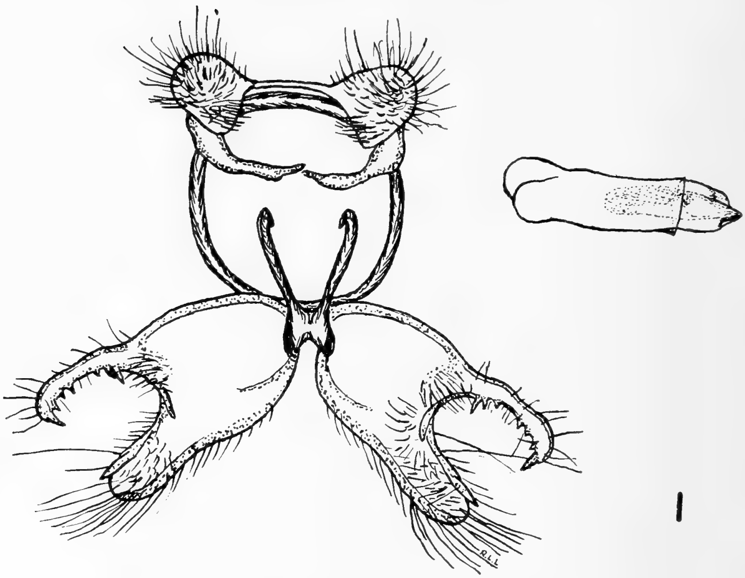
Female: Upper surface: Forewing: length 11.2 mm.; ground dark brown; underside macule at end of cell definable from ground; fringes checkered as in male; basal area with blue and white ciliae. Hindwing: ground dark brown; aurora orange, extending from M_2 to A_1 as contiguous spots forming almost a solid appearance; fringes white with no checkering; cilia of inner margin as in male; basal area with scattered blue scales and long, white ciliae. Under surface: ground with faint buff tinge, rather than pure grey; maculation as in male, except for faint aurora extending to Cu of forewing. Abdomen: sparsely covered with brown hairscales above and short, white hairscales below.

HOLOTYPE male and ALLOTYPE female: China Camp, near Point San Pedro, Marin County, California, June 17, 1961 (R. L. Langston); deposited in the California Academy of Sciences. 235 PARATYPES: listed under "Distribution"; their deposition is given at the conclusion of this paper.

The type specimens were chosen as being the most typical in color and wing pattern. The locality for the types was chosen because it is close to the center of the known distribution, with populations to the south, east, and northwest. In addition this locality appears to support a good, strong colony with the earliest specimen taken in 1958, and good series secured in 1961 and 1962. The subspecies was named for San Francisco Bay, the largest bay on the west coast of North America (Puget is called a "Sound"). The greatest numbers of individuals and known colonies are in immediate proximity to San Francisco Bay, the insects being found on steep embankments, bluffs or road-cuts close to the water.

Variation: Based on 237 specimens collected from ten distinct localities, there is very little variation. Except for occasional dwarfs and giants that give a spread to the minimum-maximum figures, the size is fairly uniform. Most individuals measured close to the average figure. By observation, no noticeable difference was noted in size between widely scattered populations. Forewing measurements were made for each population; these were combined for brevity by counties and averaged: Contra Costa Co., ♂ 11.11 mm. (8.8 - 12.1), ♀ 10.51 mm. (9.0 - 13.2); Marin Co., ♂ 11.20 mm. (9.5 - 12.2), ♀ 11.15 mm. (10.5 - 11.6); Solano Co., ♂ 10.43 mm. (10.0 - 10.9), ♀ 10.76 mm. (9.8 - 11.8); Sonoma Co., ♂ 11.33 mm. (9.8 - 12.0), ♀ 10.79 mm. (9.8 - 12.8). The extremes in size are shown in Fig. 5 D, upper. The average figures show very little variation (10.43 min. to 11.33 max.), less than one millimeter either by population or by sex. There is also much less variation in maculation than the previous subspecies treated.

Male: Forewing, average 11.12 mm. (8.8 - 12.2). The marginal band on the upperside of both wings has a tendency to become narrower and



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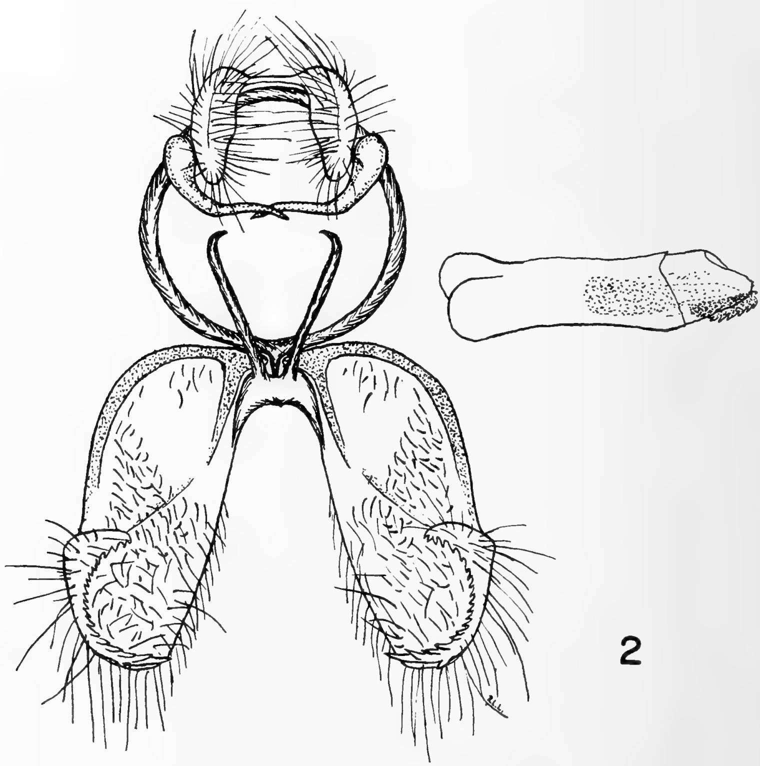

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Fig.1. ♂ genitalia of *Philotes battoides bernardino,* with aedeagus removed and shown at right.

Fig.2. ♂ genitalia of *Philotes enoptes bayensis,* with aedeagus removed and shown at right.

less distinct than on the holotype. The interneural spots on the hindwing are also reduced in some specimens (Fig. 5 D, lower), with complete absence in four specimens each from the type locality and Contra Costa County. In worn or rubbed specimens a brownish ground color becomes evident where the blue overlay is lost, and the aurora may show through, but in no case were red or orange scales actually present on the upperside. On the underside some specimens had slightly heavier maculation, others definitely lighter maculation than the holotype. The aurorae varied from a definite red to dull orange.

Female: Forewing, average 10.77 mm. (9.0 - 13.2). The most variation is in the aurora on the upperside of the hindwing, from a distinct solid band extending from R to A_1 in one specimen (Fig. 5 D, lower) to a reduction to two or three dissociated spots in others. The majority had aurorae of about the extent of the allotype. The variation of the underside parallels that of the male.

Distribution: This insect occurs quite commonly in distinct colonies around the northern and eastern periphery of San Francisco Bay and into northwestern Sonoma County. The earliest known specimens were taken at Tiburon, Marin County, in 1939. However, in recent years split-level suburbia has built up so extensively on the Tiburon Peninsula, that the host plant has become almost non-existent. In four different seasons I was able to secure only 16 specimens. The known distribution of this insect is indicated by solid circles on the map (Fig. 6), and is listed below, all specimens being designated as PARATYPES:

CONTRA COSTA Co.: Point San Pablo, Richmond, V-30-1963, 4 ♂, 4 ♀♀, VI-16-1962, 11 ♂♂, 5 ♀♀, Point Richmond, VI-16-1962, 14 ♂♂, 14 ♀♀, VI-24-1962, 23 ♂♂, 10 ♀♀, VII-4-1962, 6 ♂♂, 15 ♀♀ (all Langston).

MARIN Co.: China Camp, near Point San Pedro, VI-8-1958, 1 ♀, VI-17-1961, 15 ♂♂, 4 ♀♀, VI-9-1962, 13 ♂♂, 8 ♀♀ (Langston – "topo-paratypes"); Paradise Cay, 4 mi. E. of Corte Madera, V-29-1960, 2 ♂♂, 1 ♀ (Langston); Tiburon, VI-4-1939, 2 ♂♂ (L. I. Hewes – CAS); Tiburon, 2 mi. N. E., V-28-1958, 1 ♀, VI-9-1962, 1 ♂ (Langston); hill above Tiburon, VI-4-1963, 9 ♂♂, 5 ♀♀ (Langston).

SOLANO Co.: Carquinez Strait at Glen Cove, VI-2-1962, 4 ♂♂, 8 ♀♀ (Langston); Glen Cove, VI-8-1963, 1 ♂, 10 ♀♀ (Langston).

SONOMA Co.: Duncans Mills, 2 mi. E., VII-9-1959, 2 ♂♂, 4 ♀♀, VII-15-1959, 1 ♀, VII-7-1962, 3 ♂♂, 3 ♀♀; Forestville, 3 mi. W., VII-7-1962, 1 ♂, 1 ♀, VII-14-1962, 2 ♂♂, 4 ♀♀; Graton, 3 mi. W., VII-14-1962, 5 ♀♀; Occidental, 2 mi. W., VII-14-1962, 6 ♂♂, 12 ♀♀ (all Langston).

Host plants: In Contra Costa and Solano Counties this insect was taken on *Eriogonum latifolium auriculatum*. In Marin and Sonoma Counties it was on *E. latifolium nudum*. Both of these plants have white flowers, and are of the herbaceous-type, being leafy only at the base with bare (nude) flowering stems. This insect does not appear to stray very far from these plants, and none were found utilizing any other flowers for nectar. When these blues are scared up or missed, they will immediately fly to the closest *Eriogonum*, even against a strong wind. On cool, overcast, or windy days (where small numbers appear in the paratype records) occasional individuals were found resting in the flowering heads of the *Eriogonum*. Within the range of this insect where shrub-type buckwheat was found (*E. fasciculatum polifolium*), there was no trace of this subspecies. However, the shrub was found slightly inland, rather than in immediate proximity to the bay.

Associated Lycaenidae: If the conditions were right for the actual flying of *P. enoptes bayensis* (*e. g.* warm, no fog, absence of strong wind), *Plebejus acmon* was present in every locality, and usually in considerably greater numbers. Attracted to the *Eriogonum* in smaller numbers were several other lycaenids that fly in late spring and early summer: *Strymon melinus* Hübner, *Lycaena gorgon* (Boisduval), *L. xanthoides* (Boisduval, and occasionally *Celastrina argiolus echo* (Edwards).

Synopsis: The entire, subquadrate valvae of the male genitalia indicate this entity to be a coastal subspecies of *P. enoptes* in northern California. This subspecies may be distinguished from all others by a combination of the following characteristics: 1) the narrow marginal band on upperside of both wings of male; 2) the extension of blue into subcostal area on hindwing of male; 3) the prominent checkering of the forewing fringe on both upper and under surfaces; 4) a light underside with small, but distinct macules; 5) associated with white-flowered herbaceous-type *Eriogonum* in the coastal fog-belt; 6) adults appear in spring and early summer as opposed to the geographically nearest allopatric subspecies of *P. enoptes* being on the wing in late summer.

PHILOTES ENOPTES TILDENI Langston, NEW SUBSPECIES

Male: Upper surface: Forewing: length 10.8 mm.; overlaid scales, iridescent blue; marginal band wide, 0.80 mm., uniform, slight intrusion of blue along veins; fringes white with fuscous areas at vein ends, resulting in moderate checkering, marginal length of fuscous and white of equal alternate distribution; basal area with white ciliae. Hindwing: overlaid scales iridescent blue extending from cell and M_1 to A_2; anterior margin above M_1 fuscous, but a few scattered blue scales above cell; marginal band wide, over 1 mm., intrusion of blue along veins resulting in

scalloped appearance basally; fringes continuously white with no checkering; slight indication of aurora, but no actual orange scales present; cilia of inner margin white, sparse, up to 0.75 mm. in length; basal area with long, white ciliae.

Under surface: Forewing: ground light grey; macules relatively large and distinct, with some suffusion in anal and basal areas; a single, fused basal macule; fringes as upper surface, delineated by narrow terminal line. Hindwing: ground light grey;; macules distinct, with some suffusion of basal melanin; fringes white, almost uniform, but with very slight fuscous areas at vein ends; aurora dull orange, well developed with cusps filling interneural areas between M_1 and A_1; cilia of inner margin and basal area white, up to 1 mm. long. Abdomen: sparsely covered with white hairscales above, and short, white hairscales below; genitalia (from a topo-paratype) of the *P. enoptes* conformation; valvae entire and subquadrate with 21 discernible spines; processes of fultura inferior sharply curved at tips; paired arms of gnathos slender, terminating in spatulate points.

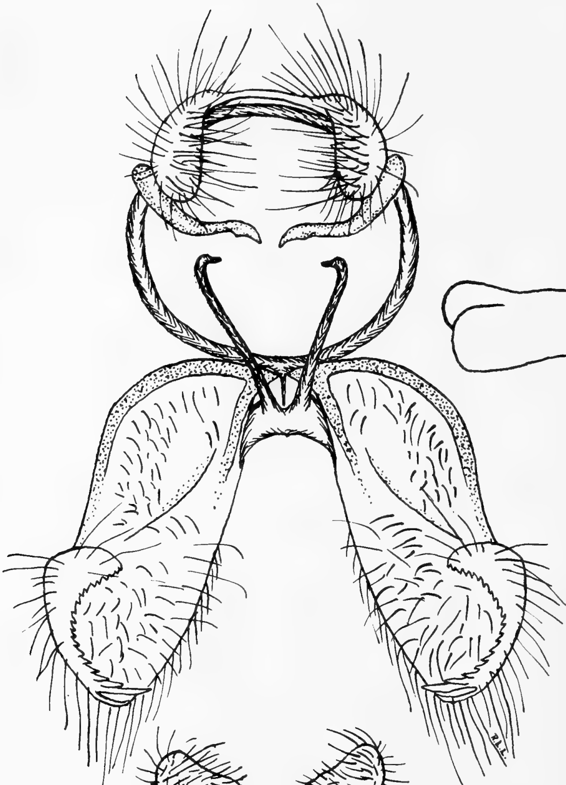
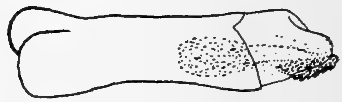
Female: Upper surface: Forewing: length 11.2 mm.; ground dark brown; underside macule at end of cell definable from ground; fringes checkered as in male; basal area with white ciliae. Hindwing: ground dark brown; aurora dull orange, extending from M_1 to A_1 with solid band appearance; fringes white with no checkering; cilia of inner margin as in male; basal area with dark brown to black scales and long, white ciliae. Under surface: ground as males, but with faint buff tinge; macules large and prominent, especially discoidal macule and basal macule of forewing; aurora extending to Cu of forewing. Abdomen: Sparsely covered with brown hairscales above and short, white hairscales below.

HOLOTYPE male: Del Puerto Canyon, 22 mi. W. of Patterson, Stanislaus County, California, August 11, 1962 (R. L. LANGSTON), and ALLOTYPE female: same locality, August 21, 1962 (J. A. POWELL); deposited in the California Academy of Sciences. 16 PARATYPES: listed under "Distribution", and their deposition at the conclusion of this paper.

The type specimens were chosen as being the most typical in color and wing pattern. The locality for the types was chosen because it is close to the center of the known distribution, with populations to the east, southwest, west and northwest. In addition, this locality appears to support the strongest colony yet found, with more specimens taken than all others combined. The subspecies was named for Dr. J. W. TILDEN, who collected the first known specimens, and who furnished information that gave an indication of the type of environment where subsequent surveys could be made.

Variation: Based on only 18 specimens from five relatively close localities, variation may be expected to be greater than stated here when more specimens become available for study.

Male: Forewing, average 11.06 mm. (9.8 - 11.8). The marginal band on the upperside of both wings has a tendency to become slightly wider or narrower than on the holotype. On the hindwing, dissociated interneural spots appeared on two specimens, a slight indication of aurora on three specimens, none in the remainder. On the underside most

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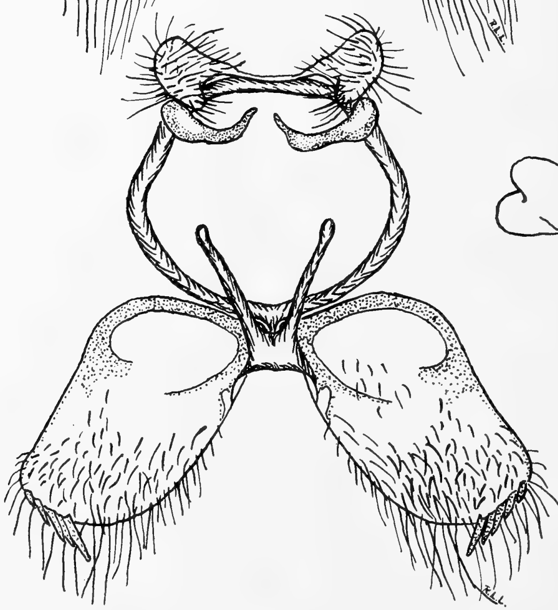
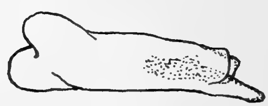

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Fig.3. ♂ genitalia of *Philotes enoptes tildeni,* with aedeagus removed and shown at right.

Fig.4. ♂ genitalia of *Philotes sonorensis,* with aedeagus removed and shown at right.

specimens had heavier maculation and a greater suffusion of basal melanin scales than the holotype. Aurorae vary from dull red to light orange, depending on the freshness of the specimens.

Female: Forewing, average 10.66 mm. (9.8 - 11.6). The most variation is in the aurora on the upperside of the hindwing. It varies in extent from M_1 (max.) or Cu_1 to A_1 but always with a solid-band appearance. The color of the aurora varies from dull orange to pale yellow, depending on freshness of the specimens. On the underside, some specimens have heavier maculation, others slightly lighter maculation than the allotype.

Distribution: At present, this Blue is known to occur only in the eastern part of the Mt. Hamilton Range of central California. It was found primarily above 2000 ft. in the digger pine belt. The known distribution of this insect is indicated by divided circles on the map (Fig. 6), and is listed below, all specimens being designated as PARATYPES:

SANTA CLARA Co.: Arroyo Bayo, E. base of Mt. Hamilton, IX-8-1953, 1 ♂, IX-12-1954, 1 ♀ (Tilden); San Antonio Valley, E. of Mt. Hamilton, IX-11-1955, 1 ♀, VIII-25-1956, 1 ♂ (Tilden); San Antonio Valley, 3.5 mi. N. of Patterson Rd. Jct., VIII-21-1962, 1 ♀ (Powell).

STANISLAUS Co.: Del Puerto Canyon, 18 mi. W. of Patterson, VIII-11-1962, 1 ♂, IX-6-1962, 1 ♂ (Langston); Del Puerto Canyon, 22 mi. W. of Patterson, VIII-21-1962, 3 ♂♂, 2 ♀♀, IX-6-1962, 3 ♂♂, 1 ♀ (Langston & Powell – "topo-paratypes").

Host plants: This insect was taken on *Eriogonum latifolium* (?) *auriculatum* and (?) *nudum*. This plant does not exactly fit the known varietal concepts, with the two questionable subspecies names being applied to plants from different localities. These plants appear the same to me. They have bright yellow flowers, and are of the herbaceous-type, being leafy only at the base with bare (nude) flowering stems.

Associated Lycaenidae & Riodinidae: At every locality where *Philotes enoptes tildeni* was found, *Plebejus acmon* was present in greater numbers. Being quite scarce, this *Philotes* is very difficult to find when there may be several dozen *P. acmon* congregated and flying around the same flowers. Attracted to the *Eriogonum* in most of the localities were good numbers of *Apodemia mormo mormo*, an occasional *Strymon melinus*, and a single *Atlides halesus* (Cramer).

Synopsis: The entire, subquadrate valvae of the male genitalia indicate this entity to be an inner coast range subspecies of *P. enoptes* in central California. This subspecies may be distinguished from all others by a combination of the following characteristics: 1) the wide

marginal band on upperside of forewing of male; 2) fuscous in subcostal area of hindwing of male, resulting in reduced amount of blue; 3) checkering of the forewing fringe on both upper and under surfaces; 4) slightly suffused underside with proportionately large macules; 5) associated with yellow-flowered herbaceous-type *Eriogonum* in the hot, interior coast range; 6) adults appear in late summer as opposed to the geographically nearest allopatric *Philotes* being on the wing in spring and very early summer.

Philotes sonorensis (Felder & Felder)

Lycaena sonorensis Felder & Felder, 1865, *Reise Fregatte Novara, Lep.* 2 (2): 281, pl.35, figs.3, 4; Strecker, 1875, *Lep., Rhop.-Het*: 105; Strecker, 1878, *Butterflies & Moths N. Am.*: 96; Wright, 1906, *Butterflies West Coast*: 223, pl.29, figs.374, b, c; Draudt *in* Seitz, 1924, *Macrolep. world* 5: 816, pl.144e, 3 figs.; Holland, 1931, *Butterfly book*, rev. ed.: 268, pl.31, figs.21, 22, pl.66, fig.45.

Lycaena regia Boisduval, 1868, *Ann. soc. ent. Belg.* 12 (2): 46; Strecker, 1874, *Lep., Rhop.-Het.*: 87; Edwards, 1875, *Butterflies N. Am.* 2 (3): 311, pl.49, figs.1-4; Strecker, 1878, *Butterflies & moths N. Am.*: 96 (places *regia* as synonym of *sonorensis*).

Philotes regia, Scudder, 1876, *Bull. Buffalo soc. nat. sci.* 3: 116 (designates *regia* as generotype of *Philotes*).

Philotes sonorensis, Dyar, 1902, *Bull. U. S. nat. mus.* 52: 43; Comstock, 1927, *Butterflies California*: 194, pl.56, figs.7-9; McDunnough, 1938, *Mem. so. Calif. acad. sci.* 1: 28; Mattoni, 1954, *Bull. so. Calif. acad. sci.* 53: 165; Downey *in* Ehrlich, 1961, *How to know the butterflies*: 237, fig.456.

This Blue is familiar to many lepidopterists, and even to general collectors specializing in other orders, as it is one of the most gaudily colored of the California Blues. The brilliant iridescence of the blue color, the arrangement of the prominent red splotches and the pattern of the black markings are completely unlike any other Blue in North America. A description here is not needed as it can easily be recognized from the illustration (Fig. 5F), and in Comstock (1927), where both sexes of *P. sonorensis* plus two named forms are shown in color.

The male genitalia (Fig. 4) differ markedly from both the *P. battoides* complex and the *P. enoptes* complex, as would be expected. In general appearance, the valvae come closer to the general shape of those of *P. enoptes*, being entire and quadrate. However, the valvae are proportionately shorter and exhibit only five well-developed spines.

Variation: With only small series collected and examined from central California, there appears to be very little variation. Some of the northern specimens tended to be slightly larger in size than the average southern California examples. A small female from southern California is illustrated in Fig. 5 F for comparison. However, any size difference may be an

artifact of the small samples from the north. Larger than "normal" specimens have also been taken in the western edge of the Colorado Desert in San Diego County. Several hundred *P. sonorensis* from southern California were examined at three museums (CAS, CIS, and LACM), plus those in my own collection. The only other variation noted is a "paler brilliance" in the shade of blue for the northern individuals. In a box containing several dozen *P. sonorensis,* the one or two individuals from the north can be easily "spotted."

Distribution: This Blue is an early spring flyer and occurs in isolated colonies due to the distribution of its food-plants. In southern California it becomes abundant in its favored localities, particularly lower canyons on both the coastal and desert sides. MATTONI (1954) gives its distribution in California as the Coast Ranges from Santa Clara to San Diego, and in Baja California to Ensenada. POWELL (1958) reports this insect from as far south as the vicinity of Punta Prieta. Data from museum specimens (CAS & CIS) show that in California *P. sonorensis* has also been taken in Imperial, Riverside, Mariposa, and Tuolumne Counties. Within the area of the present study it is considered a rare insect, having been taken only in small numbers at each of the known localities. The northern records of *P. sonorensis* are indicated by triangles on the map (Fig. 6), and are listed below:

MONTEREY Co.: Big Sur, V-4-1952, 2 ♀♀ (T. W. DAVIES).

SAN BENITO Co.: Pinnacles Natl. Mon., north road, III-31-1962, 1 ♂ (D. C. RENTZ – CAS).

SANTA CLARA Co.: Alum Rock Park, years from 1939 to 1956, earliest date II-7 to the latest date of III-16, 25 ♂♂, 5 ♀♀ (TILDEN), III-16-1940, 1 ♂, II-12-1955, 2 ♂♂ (TILDEN – CAS), III-7-1959, 5 ♂♂ (LANGSTON), III-12-1959, 1 ♀, III-12-1961, 2 ♂♂ (P. C. ENGELDER); Arroyo del Valle, E. base Mt. Hamilton, IV-15-1961, 1 ♂ (J. H. SCHOSANSKI), III-24-1962, 5 ♂♂, 2 ♀♀, III-31-1962, 3 ♂♂ (ENGELDER & SCHOSANSKI), IV-7-1962, 1 ♂ (SCHOSANSKI), IV-18-1962, 4 ♂♂ (D. ENGELDER).

STANISLAUS Co.: Adobe Creek, W. of Patterson, III-9-1956, 1 ♂ (D. BURDICK – CIS).

Life history: The early stages of *P. sonorensis* were briefly described by COMSTOCK (1927), and in much more detail by COMSTOCK and COOLIDGE (1930) where the egg, all five larval instars, and the pupa are very aptly treated. In the latter publication it is stated that the food-plants are the various species of *Sedum*. COMSTOCK and COOLIDGE continue: "The eggs are placed mainly on the undersurface of the leaves, but may also be deposited on the upper sides and even on the

stalks. The larvae feed on the contents of the thick, juicy leaves, sometimes crawling entirely within, but usually several of the posterior segments are left protruding. The apical portion of the leaves seems to be the preferred part, and even the stalk may be riddled. In moulting, the larvae withdraw from the leaves and descend usually to the undersurface. Pupation takes place in debris about, or at the base of the food-plant."

Host plants: It has been stated several places in the literature that *P. sonorensis* feeds on *Sedum* and/or various members of the Stonecrop family. Within the area of the present study, I collected it in association with *Dudleya cymosa setchellii.* To the north of the triangles on the map (Fig. 6), from closely adjacent to up to 150 miles, various types of Stonecrop were found, mostly on rocky outcroppings. The primary ones investigated were *Dudleya farinosa* and *D. caespitosa;* no *P. sonorensis* were found. Their not being found associated with these plants is based on several seasons of spring collecting from 1953 to the present.

Associated Lycaenidae: No direct, close association was noted, as was the case of the other *Philotes.* In the general vicinity were such early spring fliers as *Plebejus acmon cottlei* Grinnell and *Glaucopsyche lygdamus behrii* (Edwards).

Synopsis: Records from several collectors and specimens on deposit in museums indicate the occurrence of *P. sonorensis* in central California. This species may be distinguished from all others by a combination of the following characteristics: 1) completely different wing pattern on both upper and under surfaces; 2) different shades of wing colors on both upper and under surfaces; 3) prominent checkering of wing fringes on both upper and under surfaces – similarity to the *P. enoptes* group; 4) male genitalia with quadrate, five-spined valvae; 5) the larvae feed

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Upper: A. *P. battoides bernardino*: uppersides, ♂ & ♀. Arroyo Seco, 4 mi. E., Monterey Co., Calif., VI-11-1960, R. L. LANGSTON collector. B. *P. enoptes smithi*: uppersides, ♂ & ♀. Dolan Creek, State Hwy. 1, Monterey Co., Calif., VIII-28-1961, R. L. LANGSTON collector. C. *P. enoptes bayensis*: uppersides, Holotype ♂ & Allotype ♀. Marin Co., Calif. D. *P. enoptes bayensis*: uppersides, ♂ & ♀. Paratypes from Contra Costa Co., Calif., to illustrate size variation within a single population. E. *P. enoptes tildeni*: uppersides, Holotype ♂ & Allotype ♀. Stanislaus Co., Calif. F. *P. sonorensis*: uppersides. ♂, Alum Rock Park, Santa Clara Co., Calif., III-7-1959, R. L. LANGSTON collector; ♀, National City, San Diego Co., Calif., II-24-1951, R. L. LANGSTON collector.

Lower: A, B, C, E, F. Undersides of the same specimens as figured as uppersides, with their corresponding letters. D. *Philotes enoptes bayensis*: uppersides, ♂ & ♀. Paratypes from Solano Co., Calif., to illustrate reduced border and spots in male, and increased orange aurora in female.

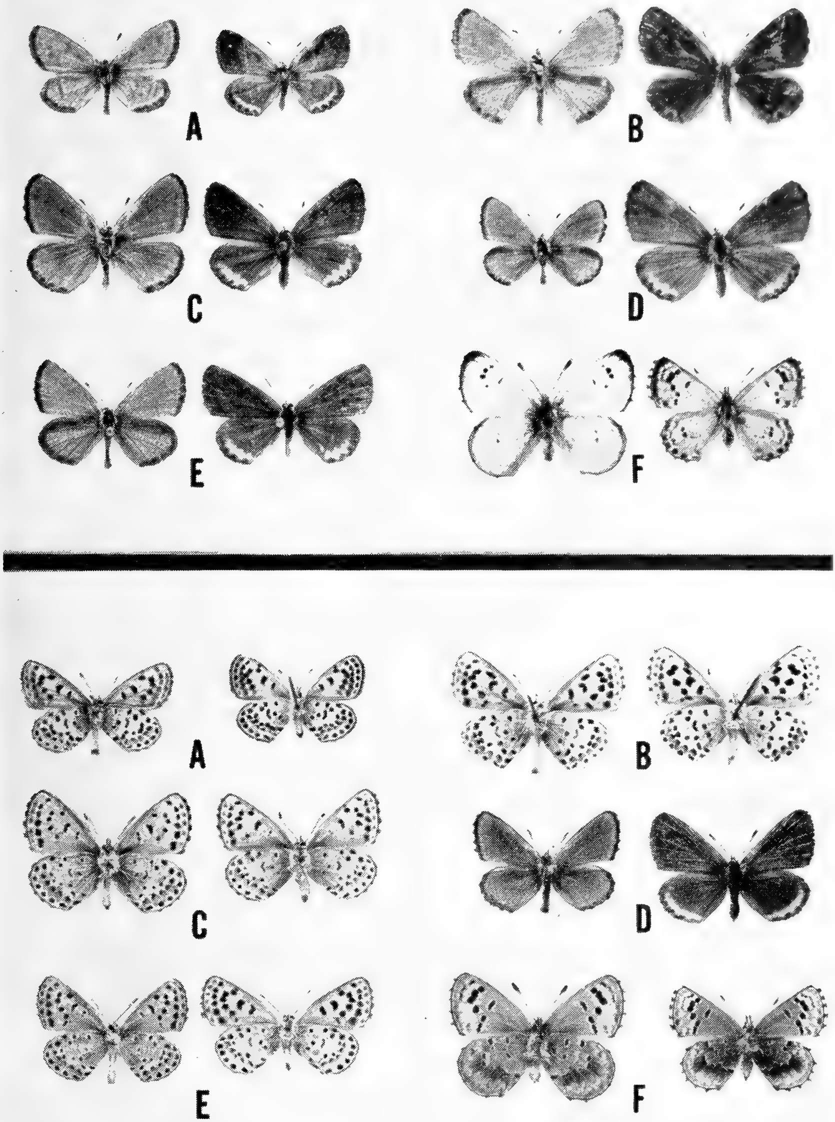

Fig.5. Adult *Philotes,* natural size. Each letter denotes a pair, with the ♂ at the left, and the ♀ at the right. (Detailed caption on page 218.)

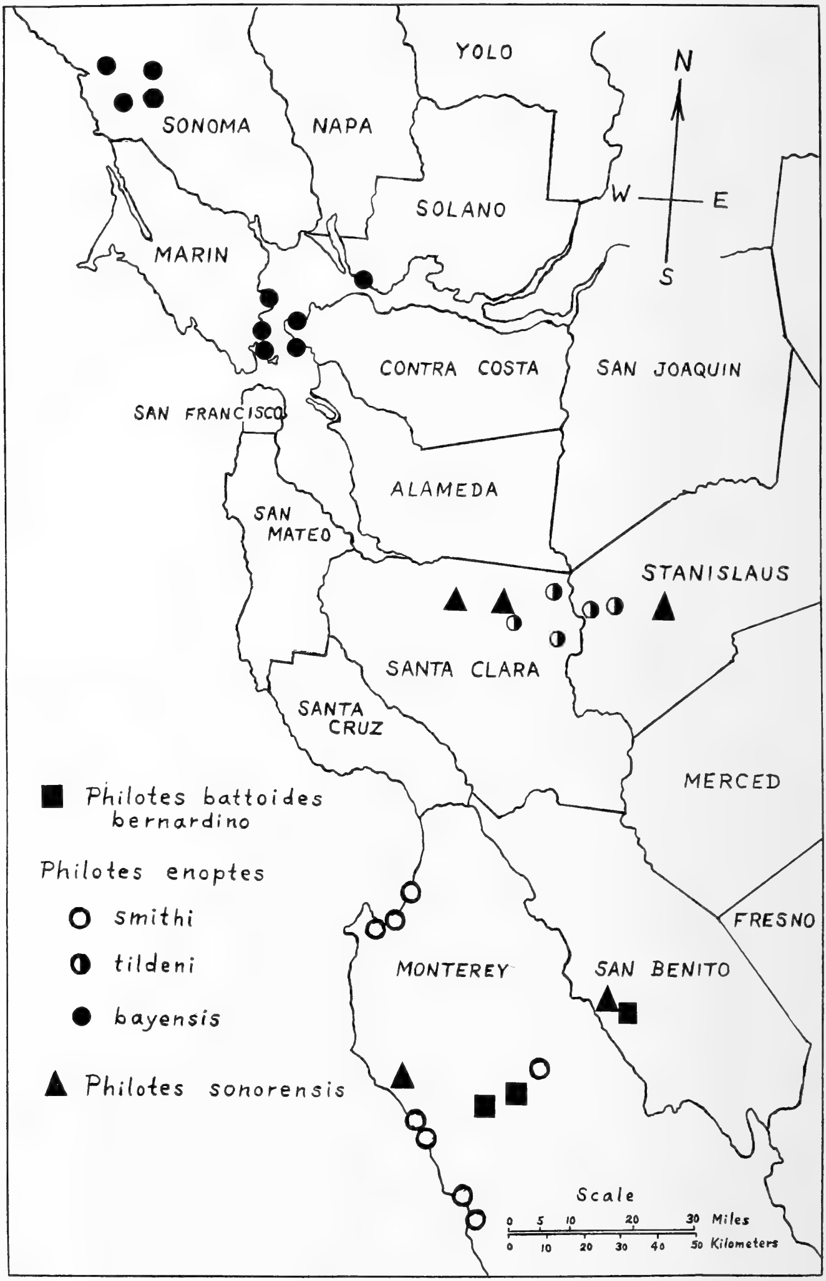

Fig.6. County map of central coastal California. Sympols indicate localities as follows: squares = northern records of *P. battoides bernardino;* open circles = known distribution of *P. enoptes smithi;* divided circles = known distribution of *P. enoptes tildeni;* closed circles = known distribution of *P. enoptes bayensis;* triangles = northern records of *P. sonorensis.*

on Stonecrop; 6) adults appear in early spring, with the flight season essentially over before any of the other *Philotes* are on the wing.

The ab. "sonoralba" Watson & W. P. Comstock, and the genetic form "comstocki" Gunder have not, as yet, been shown to occur in central California.

Discussion

The *Philotes battoides* subspecies and all three subspecies of *P. enoptes* are allopatric to each other, being well separated geographically, as will be noted in Fig. 6. These entities plus *P. sonorensis* are also separated biologically, both by host plant and flight season. The geographical separation is based not only on where the various colonies are known to occur, but where they are presumably absent, since surveys were made in the intervening areas, between the known colonies.

Spring surveys during several seasons were made: 1) in coastal Marin and Sonoma Counties on *Eriogonum latifolium* and its subsp. *nudum;* 2) eastward in Contra Costa County to the Antioch dunes on *E. latifolium saxicola;* 3) northward in Napa and Solano Counties on *E. latifolium auriculatum, saxicola,* and *E. fasciculatum polifolium;* 4) southward in Alameda and San Mateo Counties on *auriculatum* and other herbaceous-type buckwheats.

Mid and late summer surveys included: 1) immediate costal Santa Cruz County on *E. latifolium,* and on its subsp. *auriculatum* in the mountains; 2) the Mt. Hamilton Range on *E. virgatum, E. wrightii trachygonum* and *E. fasciculatum foliolosum;* 3) southward into San Benito and Monterey Counties on *E. elongatum* and *auriculatum;* 4) northward through San Joaquin Co. on *auriculatum,* Contra Costa and Napa-Yolo Counties on *auriculatum* and *saxicola,* including the Antioch dunes for several seasons. Negative surveys on *Dudleya* and other stonecrops are noted under the *P. sonorensis* host plants.

There is a distinct possibility that *Philotes* could be discovered at any or all of these intervening areas if the timing is correct. These Blues have such a short flight-period in any one micro-environment that a difference of one or two weeks too early or too late could indicate their absence. The timing also varies in different years, especially in the spring if there are unseasonably late rains and extended cloudy, cool periods.

Deposition of Material

The genitalic preparations and their corresponding specimens are deposited in CAS (7 even-numbered slides), and CIS (8 odd numbers). The holotypes, allotypes, and other specimens appearing in the photo-

graphs are deposited in CAS. Paratypes and other specimens examined in this study (represented by the first figure under each entity below), are deposited as follows, with the remaining specimens in the collection of the author.

Philotes battoides bernardino – 26 specimens (Monterey Co.): 6 in CAS; 6 in CIS; 6 in LACM.

P. enoptes smithi – 72 specimens (Monterey Co.): 6 in CAS; 38 in CIS; 6 in LACM. (22 Mattoni paratypes previously on deposit in LACM.)

P. enoptes bayensis – 235 paratypes (Contra Costa, Marin, Solano & Sonoma Counties): 50 in CAS; 50 in CIS; 50 in LACM; 10 in the collection of J. W. TILDEN.

P. enoptes tildeni – 16 paratypes (Santa Clara & Stanislaus Counties): 2 in CAS; 4 in CIS; 2 in LACM; 4 plus one genitalia slide in the collection of J. W. TILDEN.

P. sonorensis – 10 specimens (San Benito, Santa Clara & Stanislaus Counties): 6 in CAS; 3 in CIS; 1 in LACM.

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SUMMARY

1. *Philotes battoides bernardino, P. enoptes smithi, P. enoptes bayensis, P. enoptes tildeni* and *P. sonorensis* are found in coastal California from the central areas to the North Coast Range.

2. Those subspecies in the *P. battoides* and *P. enoptes* groups occur in distinct colonies and are allopatric, being well separated geographically.

3. All of these *Philotes* can be distinguished from each other by a combination of morphology, host plants, and flight season.

4. The subspecies of *P. battoides* and *P. enoptes* are each associated with different types of *Eriogonum*, while the early stages of *P. sonorensis* are known to feed on *Dudleya* and *Sedum*.

5. The ubiquitous *Plebejus acmon* feeds on, and adults are attracted to the flowers of *Eriogonum,* thus making difficult the detection of most of the *Philotes,* which occur in lesser numbers and have a much shorter flight season.

6. The appearance of the adults of the *Eriogonum*-feeding *Philotes* is correlated with the early full-bloom of these plants, and hence they are often found flying in association with butterflies of the *Apodemia mormo* complex.

7. Some of these *Philotes* entities appear to barely eke out an existence in central California, with two of them (*bernardino* and *sonorensis*) occurring much more commonly to the south, ranging extensively throughout southern California and Baja California.

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AN AGGREGATION OF *CALLIMORPHA EQUITALIS* (ARCTIIDAE) IN THE HIMALAYAS

The hill station of Mussoorie in northwest India is famous for its great variety of butterflies, moths and beetles. On June 1, 1960, while hiking several miles off Tehri Road near Mussoorie to a place locally known as "Scott's Hole", we witnessed a most unusual aggregation of tiger-moths at an altitude of about 5,000 feet.

When collecting butterflies in the nullah approaching "Scott's Hole", our movements disturbed some moths. These moths attracted our attention to nearby shrubs and trees, which were literally covered with moths. The branches drooped under their weight. The first swing of my net at one of these branches netted about forty *Callimorpha* moths. The net seemed so heavy that I instantly knelt on the ground and began to select the perfect specimens for the American Museum of Natural History and for my own collection. Unfortunately, no member of our party had brought his camera and no one wanted to walk back six miles to get one.

As we knew of no way to count this huge aggregation of moths, we estimated that they were present by the thousands or even tens of thousands.

The moths seemed very listless. Only after beating a moth-covered branch with the handle of my net was I able to make the moths fly. They settled on nearby trees and shrubs where they were easily captured. Whether this aggregation of thousands of the moths represented a form of hibernation or aestivation or a normal rest-stop during migration, I am unable to say. In any case, this was the largest aggregation of moths of a single species that I had ever seen.

Mr. N. T. NADKARNY of the Bombay Natural History Society identified the moths as *Callimorpha equitalis*. Mounted specimens measured from 65 to 75 mm. According to MEYRICK *Callimorpha* (=*Panaxia*) is the most ancestral form of Arctiidae, but HAMPSON (*Moths of India*; 1892-96) placed it in the Hypsidae.

ERNEST M. SHULL, Ahwa, via Bilimora, Dangs District, Gujarat, INDIA

AN ANNOTATED LIST OF LEPIDOPTERA OBSERVED OR COLLECTED IN 1959-1960 ON THE DRY TORTUGAS ISLANDS

by G. W. Rawson and W. M. Davidson

While assisting in the banding of Sooty and Noddy Terns breeding on Bush Key in the Dry Tortugas, off the southern tip of Florida, we had opportunity during lay-offs and rest periods and at various lights at old Fort Jefferson, to observe and capture Lepidoptera.

As far as the observations extended, it would appear that the lepidopterous fauna is similar to that of southern Florida and is only weakly represented by true exotics. The seven small islands which make up the Tortugas group are rather sparsely vegetated; the flora is mainly composed of sedges, grasses, Spanish Needles (*Bidens leucantha*), Sea Purslane (*Sesuvium*), the composite *Melanthera deltoides,* Button Mangrove (*Conocarpus erectus*), and Bay Cedar (*Suriana maritima*). On Garden Key, on which Fort Jefferson stands, such plants as Coconut Palm, Date Palm, Avocado, Royal Ponciana, Agave, and Yucca have been introduced. Although isolated from the mainland by 68 miles and from Cuba by about 120 miles, several species appear to be migrants to the islands. Notable among these were *Colias eurytheme, Phoebis agarithe,* and *Vanessa virginiensis.* During the Nineteenth Century until 1847, Fort Jefferson was garrisoned by a Federal Army. This occupation might have affected the local insect populations and added introduced species, of which the descendants may still persist.

The following list is necessarily spotty, since we spent only a few days on each of three visits, namely one in late May 1959, and two in late May and early July 1960.

Danaus plexippus L. Several were seen flying over the Gulf of Mexico while we were on board the Park Service and Coast Guard boats, and two appeared on Garden Key in 1960.

Phyciodes phaon Edw. Relatively common on the parade ground at Fort Jefferson where the food-plant *Lippia nodiflora* grew in patches.

Vanessa atalanta L. Two taken on Garden Key.

Vanessa virginiensis Drury. Two collected on Garden Key, July 1960.

Junonia lavinia zonalis Felder. Several taken on Garden Key in early July 1960 were identical with the form *zonalis,* which is common on the mainland in central and southern Florida. It is of interest to state that the typical form *coenia* is rather scarce in spring and early summer at least in the Daytona Beach area, while the form *zonalis* replaces *coenia,*

sometimes in very large numbers, in the fall and early winter. The status of this complex is problematic and certainly worthy of intensive study.

Strymon martialis H.-S. In late May 1959 a small flight in somewhat battered condition was associated with Button Mangroves on Garden Key. In July 1960 two dozen or more were frequenting flowers of *Melanthera and Bidens*. This species appears to be endemic, although the Nettle Tree (*Trema floridana*), stated by A. B. KLOTS in his *Field Guide to the Butterflies* as being the larval food-plant, was not found.

Strymon columella Fabr. Occurred in abundance at each visit on Garden, Hospital, and Bush Keys. KLOTS (*op. cit.*) does not give a food-plant. Our individuals were taken on Spanish Needles, *Melanthera* blooms, and Bay Cedar. Careful search for eggs and larvae on Bay Cedars was unproductive, although there appeared to be a close association between insect and plant.

Colias eurytheme Bdv. Two males were taken on Garden Key in July 1960. These captures were surprising, since *eurytheme* is said to be very rare in southern Florida. We have, however, observed considerable flights in central Florida in recent years and noted oviposition on *Sesbania*. The existence of small patches of clover on Garden Key suggests that breeding could occur, but we believe our individuals were migrants.

Phoebis agarithe Bdv. Several seen flying on Garden Key July 1960.

Eurema nicippe Cram. Several including the pale phase, on Garden Key.

Eurema lisa Bdv. & Lec. Several on Garden Key July 1960. The presence of plants of the Senna and Pea families suggests that these two *Eurema* may be indigenous.

Ascia monuste L. In July 1960 a dozen or more were seen and taken on Garden Key and many occurred on Hospital Key. The females were form "phileta". Larvae were seen on Sea Rocket (*Cakile edentula*).

Hylephila phyleas Drury. One female taken on the shore of Garden Key, July 1960.

Panoquina panoquinoides Skin. Several collected about flower heads of *Melanthera*.

Erinnyis obscura Fabr. 1 specimen caught in spider web, Garden Key, July 1960.

Melipotis contorta Gn., *M. januaris* Gn., *M. prolata* Wlk. Common in July 1960 about the Fort buildings, attracted to light.

Casandria filifera Wlk., *Leucania* sp., *Anticarsia repugnalis* Hbn. 1 of each.

Caenurgia chloropha Hbn. 2 on parade ground, May 1959.

Hemeroplanis scopulaepes Haw. 1 bred from pupa July 1960.

Erebus odorata L. This large and spectacular moth, which greatly resembles a bat in flight, was first brought to our attention by one of the staff members of the Park Service advising that it was to be found on the dark walls of the Fort cloisters. Several were taken, but when resting on the dark recesses of the old fort they were very difficult to distinguish on the dusky background of brickwork, even with a flashlight. Since *E. odorata* is known to breed in Florida its presence on Garden Key was not surprising.

Diaphania indica, Pyrausta penitalis Grt., *Hymenia recurvalis* F. 1 of each, on Garden Key, July 1960.

In conclusion we wish to thank Mr. Charles P. Kimball, West Barnstable, Massachusetts, and Mr. Stanley V. Fuller, Cassadega, Florida, for their determination of most of the moths.

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NOTES ON THE OCCURRENCE OF *AGRAULIS VANILLAE* (NYMPHALIDAE) IN THE MIDWEST

by Richard D. Turner

Recently there has been considerable interest concerning the establishment of *Agraulis vanillae* (Linnaeus) in the central valley of California and along the coast to the San Francisco Bay area. The northward movement of this species from the southern part of that state, where it has long been established, has been attributed to the milder climatic conditions which the central sections have been experiencing. There was some doubt as to whether the species would continue to survive because of colder spells during the winter of 1959-1960. A female *A. vanillae* was observed ovipositing on fresh growth of the ornamental Passion Vine during April, 1960; apparently the species has been able to overwinter again in that area.

In view of these recent developments concerning the hardiness of *A. vanillae* it is of interest that for three consecutive winters this species managed to survive in west-central Missouri. Aside from the many really cold spells which occur, with temperatures dipping to zero and below,

if only for a short time, this species is further encumbered by the fact that its food-plant, the hardy Passion Vine, *Passiflora incarnata* Linnaeus, doesn't appear above ground until very late spring, generally toward the later part of May. During the summer the vine grows luxuriantly and covers large areas until mid-autumn when its tender foliage is completely destroyed by the first hard freeze.

During the first week of July 1953 a female *A. vanillae* found these vines. They were draped over large sections of lilac bushes, perhaps the mark of a bad gardener but evidently most acceptable from this butterfly's point of view. She soon deposited many eggs on the fresh growth of unopened leaves. Later in the summer when the adults emerged the vines were visited by many of her kind. Again eggs were laid and thus another generation was assured, provided it could overwinter.

The experiment was a complete success that winter, for during the summer of 1954, when the vines spread to another part of the garden, so did *A. vanillae.* That was the peak year for this isolated colony and at times adults fairly swarmed around the Passion Vines, which were well populated with eggs and larvae. Pupae hung from awnings, rose trellises and lawn chairs. Larvae were in many stages of growth, as the broods overlapped.

Again the colony survived the winter; during the middle of June, 1955, the adults began to appear. Although they became nearly as numerous as during the preceding summer, something apparently upset their balance. The great majority of specimens were males ranging from normal down to quite diminutive sizes with wing-spans scarcely exceeding 1½ inches. The number of female specimens had so greatly declined that only a very few were observed throughout the summer.

The isolated and once thriving colony of these butterflies ended in late June 1956, almost as it had begun, with a single *A. vanillae.* It was a female and she stayed for several days hovering over the Passion Vines. Then I saw her no more. Although she probably met with some unfortunate accident I prefer to think she safely found her way back to the metropolis of her kind where winters are mild and Passion Vines grow the year around. Who there would suspect that this was the sole survivor of an experimental colony that flourished so successfully if briefly in an alien climate!

As to whether the overwintering stage was larva or pupa I was never definitely able to determine. Dr. RICHARD M. FOX, of the Carnegie Museum, with whom I corresponded in reference to the subject, suggested the pupa on general principles, as the semitropically adjusted larva would have scant protection physiologically against the cold of the north.

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AN EIGHTEENTH-CENTURY EXPERIMENT ON THE PROMOTION OF LARVAL DEVELOPMENT BY ELECTROSTATIC CHARGES

by Philip C. Ritterbush

In the Eighteenth Century many speculative naturalists supposed that charges from electrostatic generators might stimulate organic processes. Their writings are of considerable interest to the historian of ideas concerned with various notions about all-pervasive subtle fluids and electrical energy, which seem to have had their principal origin in the hypothetical queries appended to Newton's *Opticks*. Discoveries of "natural electricity" in the atmosphere and in varieties of electric fish lent impetus to the ideas, which influenced the experimental work of Luigi Galvani and Alexander von Humboldt, among others. These ideas permitted naturalists to acquiesce in preconceived theories of life which satisfied curiosity but, with the exception of a few Continental investigators, did not provoke experiments on living things.

One of the exceptions may interest modern insect physiologists. In 1788 and 1789 a French naturalist, d'Ormoy, of whom nothing else is known to me, performed experiments which seem to indicate that electricity may stimulate larval development. His results were reported in Rozier's *Observations et mémoires sur la physique* . . . for September, 1789 (Vol. 35, part 2: pp. [175-176]), under the title, "De l'influence de l'électricité sur la végétation, prouvée par de nouvelles expériences." I translate the portion of his article devoted to the experiment as follows:

> On the 22nd of April I took one hundred and fifty silkworms, which had all emerged that day from the same eggs. I divided them into two groups: one destined for electrification and the other to remain unelectrified, but with the same exposure and food. I communicated the electric fluid to them in the following manner: when they were still young I simply put them on the magic table [the so-called "prime conductor" of electrostatic generators], which was charged with three or four hundred turns of the wheel hourly from six in the morning until nine in the evening. When they had grown to a larger size I placed them on a cake of resin which communicated with the conductor by means of a strip of metal. I would further observe that I fed them only twice a day, just as was done with those not electrified.
>
> By June 4th I had more cocoons among the electrified silkworms.
>
> By June 5th and 6th the majority were occupied with spinning while those not electrified were still in their third stage of growth.
>
> In 1788 I had the same results in conducting the same experiment and I observed, as I did this year, that electricity made them more vigorous, increased their

hunger, and preserved them from those diseases to which those not electrified were so strongly subject, when, for example, I gave them to eat two leaves cut when they were moist, or after the rain.

The temperature in the apartments during these experiments ranged from 13 to 17 degrees centigrade. Through the use of controls D'ORMOY sought to isolate any special circumstances which may have promoted growth in his experimental group. Even the more advanced group, incidentally, began to spin about a week later than those observed by LINNAEUS in Uppsala, as described in *Phalaena bombyx, Amoenitates Academicae,* vol. 4: pp.560-561; 1760.

D'ORMOY also tabulated the size of plants grown from seeds which had been electrified, in pots which were electrified, and compared them to control specimens grown under similar conditions of light, heat, and moisture. The effect of small electric charges in promoting the growth of plants has been the subject of recent investigation, but a search of the indexes discloses that this has not been the case in insect development. It is tempting to dismiss D'ORMOY's experiments as crude efforts in which crowding of the larvae and a disposition in favor of theories of electrical influence may have had more effect than the electrostatic charges. I think that the wiser course, however, would be to bring this account to the attention of those able to judge its merit in the eyes of modern science.

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CHROMOSOME NUMBERS IN GEOGRAPHIC POPULATIONS OF THE *UTETHEISA ORNATRIX* (ARCTIIDAE) COMPLEX AND CERTAIN HYBRIDS

by Roger W. Pease, Jr.

The *Utetheisa ornatrix* complex, of five geographic populations, varies in five striking characters of wing pattern and pigmentation. The purpose of this paper is to report the results of cytological examination of three of these subspecies and hybrids between them.

Chromosome complements of the Southern Continental form from Saint Thomas, V. I. (*U. o. ornatrix* L.), Puerto Rican from near Aguas Buenas, Puerto Rico (*U. o. stretchii* Butler) and Northern Continental from Lake Placid, Florida (*U. o. bella* L.) were examined together with laboratory hybrids of ♀ Southern Continental × ♂ Northern Continental (Grand Bahama, B. W. I.) and the reciprocal cross.

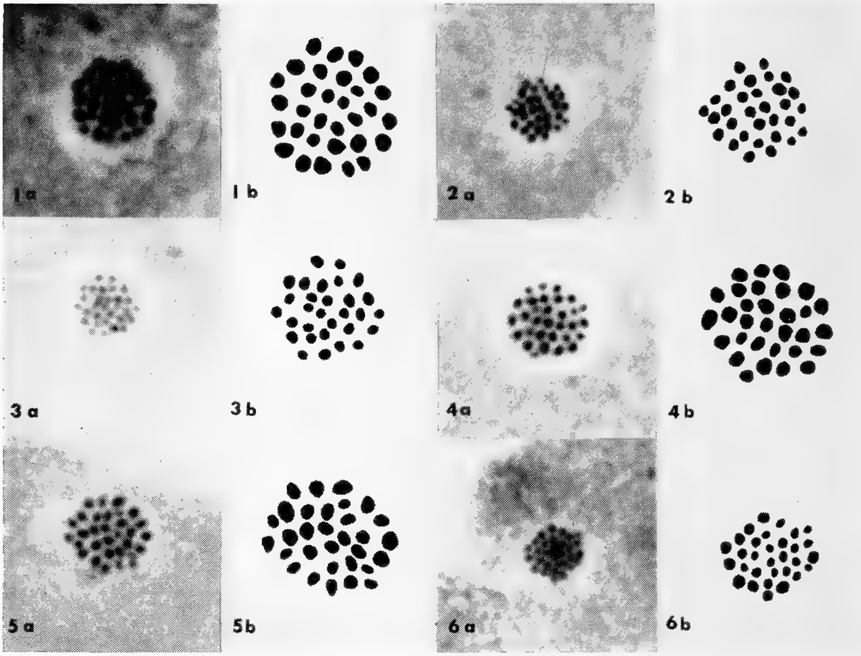
Testes were removed from the dorsal region of the fifth abdominal segment in late instar male larvae by making an incision along the venter. Allen's P. F. A. – 3 was used as the fixative. The gonads were embedded in paraffin, sectioned at 8 or 10 mu, stained with Heidenhain's Iron Hematoxylin, and counterstained with light green.

Slides were were examined under oil at a magnification of 2250×. The drawings were made with camera lucida. Photographs were taken on 35mm panatomic X film at 300× and enlarged six diameters to give a total magnification of 1800×.

1. Northern Continental population (*Utetheisa ornatrix bella*). $N = 31$. Counts were made in 73 nuclei (I) and 15 nuclei (II) from 4 male larvae raised from a stock collected at the Archbold Biological Station, Highlands Co. Florida. One nucleus (II) had $n = 30$.

2. Southern Continental populations (*U. o. ornatrix*). $N = 31$. Counts were made in 6 nuclei (I) from one male larva bred from a stock collected in Saint Thomas, Virgin Islands.

3. Puerto Rican population (*U. o. stretchii*). $N = 31$. Counts were made in 67 nuclei (I) and 9 nuclei (II) from 2 male larvae from stocks collected near Aguas Buenas, Puerto Rico. One of these nuclei (I) had $n = 32$.



Meiotic metaphase figures from sectioned, stained testes of the *Utetheisa ornatrix* complex. Figs. 1a, 1b — No. Continental population (*U. ornatrix bella* — Florida, U. S. A.). Figs. 2a, 2b — same (II; $n = 31$). Figs. 3a, 3b — same (II; $n = 30$). Figs. 4a, 4b — Puerto Rican population (*U. o. stretchii*) (I; $n = 31$). Fig. 5a, 5b — F_1 hybrid of ♀ Southern Continental (*U. o. ornatrix* — St. Thomas, V. I.) × ♂ No. Continental (*U. o. bella* — Grand Bahama, B.W.I.) (I; $n = 31$). Figs. 6a, 6b — same (II; $n = 31$). [I = primary spermatocyte division, II = secondary spermatocyte division; magnifications are 1800× in the photographs.]

4. Hybrid (F_1) between ♀ So. Continental (Saint Thomas, V. I.) × ♂ No. Continental (Grand Bahama, B. W. I.). $N = 31$. Counts were made in 74 nuclei (I) and 11 nuclei (II) from 3 male larvae reared in the laboratory. Four of these nuclei (I) had $n = 30$.

5. Hybrid (F_1) between ♀ No. Continental (Grand Bahama, B. W. I.) × ♂ So. Continental (Saint Thomas, V. I.). $N = 31$. Counts were made on 37 (I) nuclei and 9 nuclei (II) from 2 larvae bred in the laboratory. One of these nuclei (I) had $n = 30$.

The majority of primary and secondary spermatocyte metaphase figures in the three subspecies tested and the hybrids have 31 chromosomes. A single primary figure of the Puerto Rican population has 32 chromo-

somes. This may be explained as a single bivalent which separated at metaphase slightly before the rest. Of the total for the three populations and the hybrids there were five primary figures and two secondary figures with 30 chromosomes. Figures with both 30 and 31 chromosomes occur in the same specimen.

Aberrant chromosome numbers can be caused by non-pairing of chromosomes in hybrids. However, if the unusual figures resulted from non-pairing at primary metaphase, only increased numbers would be seen in the first division (I). Reductions in number would not be found until the second metaphase. Therefore, the unusual counts are not the result of failure of pairing in the first metaphase of hybrids.

It is concluded that the Northern Continental, Southern Continental, and Puerto Rican populations, and hybrids between the first two have a normal complement of $n = 31$ chromosomes. There is no evidence of chromosomal incompatibility in crosses between the most different phenotypically of the geographic subunits of the *U. ornatrix* complex, since hybrids between the Northern Continental and Southern Continental populations do not have increased numbers of chromosomes in the primary metaphase due to non-pairing of chromosomes or increased variation in chromosome number in the secondary metaphase due to difficulties in separation and movement to the poles.

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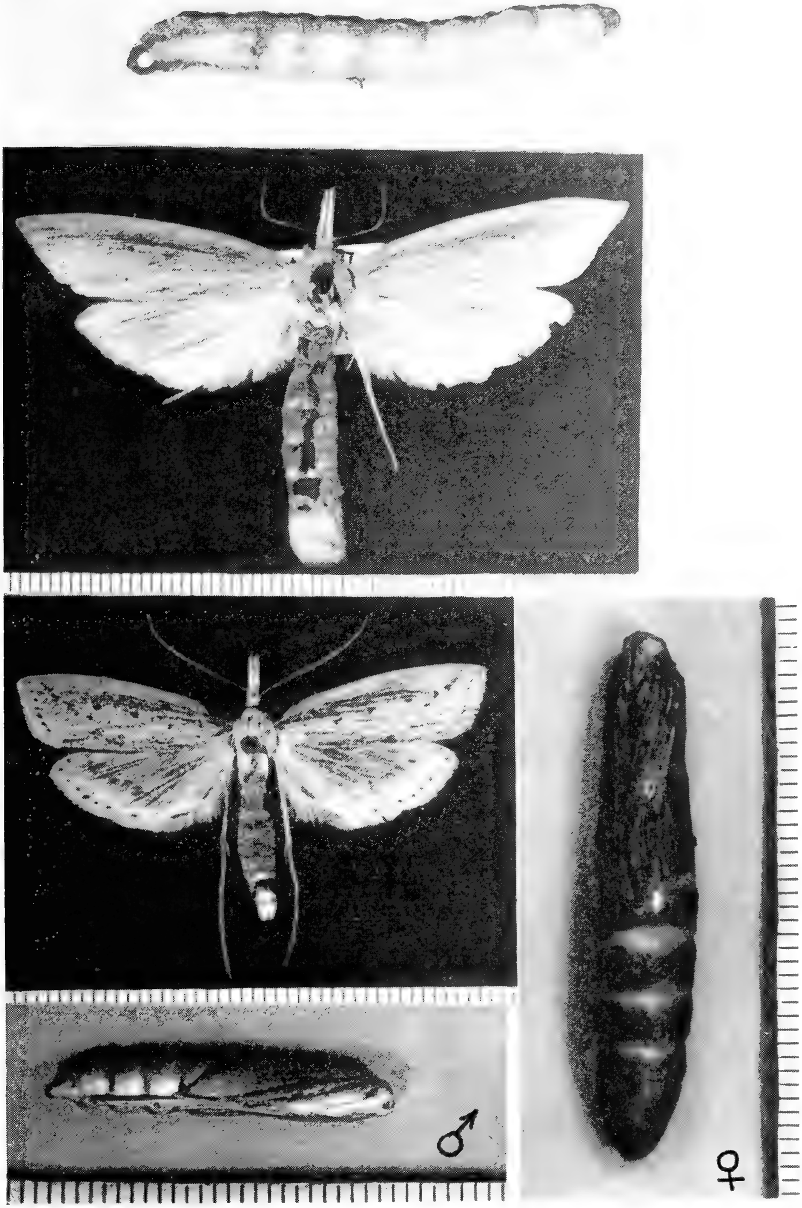
CONTRIBUTION TO THE LIFE HISTORY OF *SCHOENOBIUS MAXIMELLUS* (PYRALIDIDAE)

by A. Blanchard

In Wm. T. M. Forbes' "The Lepidoptera of New York and Neighboring States" (part 1: 525; 1923), there is a note which reads in part: "The Schoenobiinae are a small group of more or less aquatic moths . . . The larvae are hardly known structurally, and are borers in marsh and aquatic plants . . ." Of the genus *Schoenobius,* the same author says that it is a very difficult one in the South, and is not well understood. Of *Schoenobius maximellus* Fernald, he states "male unknown." When I sent some specimens for identification to the United States National Museum, I was told that this institution had no males in its collection. I have, by sheer luck, found one food plant of this species and observed many larvae and males, and I hope that the following biological notes will be of interest.

All around Don George Lake (ten miles southeast of Richmond, Fort Bend County, Texas) grows a tall, coarse Gramineae: *Zizaniopsis miliacea* (Michx.) Doell & Aschers (or Southern Wild Rice). I have seen the same plant in a few other places (Huntsville State Park, Freeport, Rosenberg, Welder Wildlife Foundation), but nowhere as abundant as it is around Don George Lake, where it has practically crowded out all other plants, at least along the southern shore. The larva of *Schoenobius maximellus* bores vertically along the axis of this plant, in the leaves, and even penetrates several millimeters into the hard crown. I have always found it head down at the bottom of its burrow, except when it is ready to pupate.

It pupates head up at the bottom of the burrow or very close to it, after covering the walls with a fine layer of white silk. The top of the cocoon is closed by a series of trap-door-like obturations more or less evenly spaced a few millimeters apart. The obturation which is immediately on top of the pupa seems more silky than the others and may be built differently or with greater care than the others, as it is very often the only one which remains watertight. Five or six obturations are not at all uncommon. The exit hole is sideways, just above the top obturation. It must be difficult for the larva to upright itself, prior to pupation, in a burrow the cross-section of which is not appreciably larger than the cross-section of its own body.



Schoenobius maximellus

Left, top to bottom: larva; ♀ adult; ♂ adult; ♂ pupa. Right, ♀ pupa. The graduations are millimetric.

The female larvae and pupae are considerably larger than those of the males, although both vary very much in size: length of the female pupae 28 to 38 mm., diameter 5 to 8 mm. An average male pupa is 25 mm. long and 4 to 5 mm. in diameter. A striking difference between the male and female pupae is that the tongue of the male pupa almost reaches or slightly protrudes beyond the anal end, whereas the female tongue goes only slightly beyond the wing cases. The adult female has a wingspread of about 60 mm., the male only 40 mm.

During the first week of December, 1961, I collected four larvae, which were spinning their cocoons, and eleven pupae. December 20 and 24, 1961, I collected about a dozen larvae and three times as many pupae. They hatched during January and the first two weeks of February, 1962; both sexes were in about equal numbers. April 28, 1962, I collected one larva and two pupae. I have captured a male adult June 22, 1962, at the Welder Wildlife Foundation. I collected at Don George Lake, December 15, 1962, eight pupae, one of which was ready to emerge. So it seems that there is a generation during the early winter months and one or more generations during the remainder of the year.

I acknowledge with thanks the help given me by Mr. HAHN W. CAPPS, of the Insect Identification and Parasite Introduction of the Department of Agriculture, who identified the adults, and Mr. JASON R. SWALLEN, of the Department of Botany of the United States National Museum, who identified the food plant.

I do not feel qualified to describe the immature stages of this species, but would be happy to collect some material for anyone interested in doing so.

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A PICTORIAL KEY TO THE NORTH AMERICAN MOTHS OF THE FAMILY OPOSTEGIDAE

by JOHN R. EYER

The following account is the result of several years study of moths of the genus *Opostega,* particularly representatives of North American species, from the U. S. National Museum, the Canada Department of Agriculture, the American Museum of Natural History, the Los Angeles County Museum, Cornell University, and several private collections. Whenever possible, types, paratypes, and/or specimens "compared with type" were included. Since the present location of CHAMBERS' types of *O. nonstrigella* and *quadristrigella* is not known, specimens which conformed most closely with the original descriptions were selected for genitalia characterization; specimens which agreed most closely with CHAMBERS' description proved, on examination of genitalia, to be *O. albogalleriella* Clem.

The position of the family, composed of the single genus *Opostega,* in the classification of Microlepidoptera is problematic. SPULER (1913) included *Opostega* as a subfamily of the Nepticulidae but recommended its elevation to family rank. MEYRICK (1928) placed the genus in the family Lyonetiidae remarking that it exhibited "the extreme of neural degeneration and the largest eyecap of any of the representatives" (Plate 1). FORBES (1923) described its phylogenetic status as follows, ". . . the group seems to represent, as near as anything, the point of origin of the Lyonetiidae from the common Tineoid stem, as it shows characters that appear also in the Tineidae, Nepticulidae, Psychidae, and Lyonetiidae." HEINRICH (1918), basing his opinions on a study of the larva, included also resemblances with the Tischeriidae.

The North American representatives are usually white in color (Plate 1) with obscure gray or brown markings and because of their small size and fragile texture are frequently rubbed and difficult to distinguish. The presence of a conspicuous pectinifer in the male genitalia has proven most useful in separating this family from the Nepticulidae and Lyonetiidae; and the shape of the anellus of the male and of the ostium pads of the female in the distinguishing of species. The five species may be divided into two groups on the basis of wing pattern and male and female genitalia as follows:

Group I, (Plate 2, figures in upper brackets) which includes only the species *O. scioterma* Meyr., exhibits both a dorsal and costal color spot


VERY LARGE
EYE CAP
DARK IRIDESCENT
APICAL SPOT
MALE GENITALIA WITH
PROMINENT PECTINIFERS
DOUBLE ROW OF
HIND TIBIAL SPINES
OPOSTEGA
(SINGLE GENUS)
SEVERAL LONGITUDINAL VEINS
NO CROSS VEINS; NO CELLS
FEMALE GENITALIA:
MONOTRYSIAN; NONPIERCING

on the front wing and the darker color markings of the tornus are less distinct than in the representatives of the second group. The male genitalia possess a tubular, membranous, ædœagus reinforced by a longitudinal, chitinous fold and it enters the diaphragma through a membranous, semi-cylindrical anellus. The saccus of the vinculum is reflexed and forms an inverted "U". The socii are fused to form a transverse plate across the hind margin of the tegumen. The valve is cylindrical, lacks a distal prolongation of the sacculus, and the pectinifer is attached terminally. It is small, in comparison with the representatives of Group II, and bears 15-20 teeth.

The female genitalia are of the monotrysian type with very rudimentary apophyses and no modifications for cutting or piercing. Ostium pads are absent and the ninth tergite is hood-like with its caudal margin entire.

Group II (Plate 2, figures in lower brackets) includes the four species, *i. e., O. cretea* Meyr., *O. quadristrigella* Cham., *O. albogalleriella* Clem., and *O. bistrigulella* Braun. The forewings possess only the dorsal spot and the markings of the tornus are arranged in diagonal fascia or narrower bands termed "strigils," which radiate from the dark iridescent apical dot.

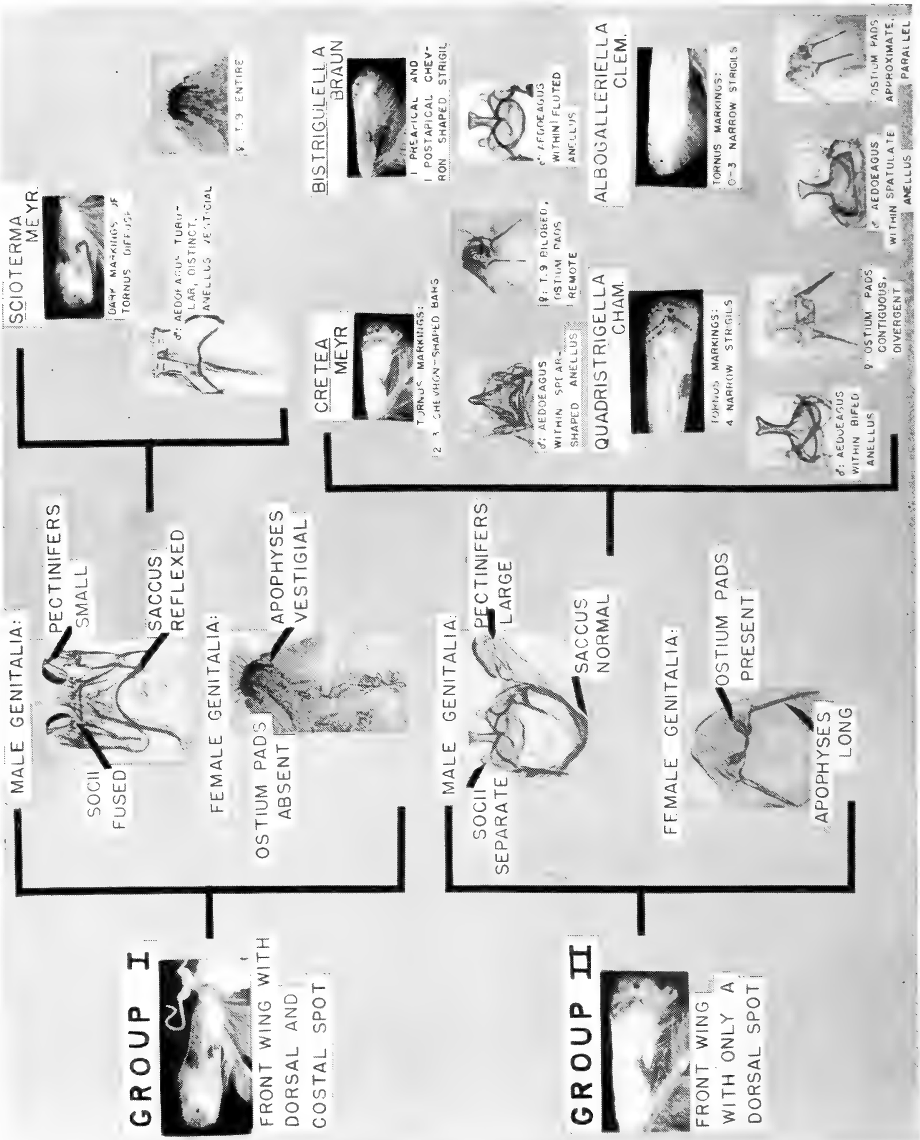
The male genitalia possess a flat, membranous ædœagus which enters the diaphragma through a heavily chitinized, saddle-shaped anellus. The vinculum extends posteriorly as a U- or V-shaped saccus. In some species this structure may be a combination of the anellus and gnathos. Due to the suppression of the 10th somite a study of the pupal development is necessary to establish the homologies correctly. The tegumen bears a pair of small separate socii attached laterally above the anal tube. The sacculus of the valve is extended posteriorly into a finger-like process. The pectinifer is comparatively large, possesses 30-45 teeth, and is articulated about midway along the costa.

The female genitalia possess a transverse plate, ventral of the genital opening, which bears a pair of short processes, named "ostium pads" by PIERCE (1935). The posterior margin of the ninth tergite is indented and forms two setiferous lobes.

The distinguishing characters of the four species are summarized as follows:

Opostega cretea Meyrick.

Anterior wing with a distinct dorsal spot extending diagonally forward and into the discal area. Tornus with three broad, costal fascia and one or two additional fascia in the posterior fringe. Posterior wing tan or gray. Four melanistic specimens were observed in which also the front wings were a brownish color, hence masking the fascia.


GROUP I
FRONT WING WITH DORSAL AND COSTAL SPOT
MALE GENITALIA:
PECTINIFERS SMALL
SOCII FUSED
SACCUS REFLEXED
FEMALE GENITALIA:
OSTIUM PADS ABSENT
APOPHYSES VESTIGIAL
SCIOTERMA MEYR.
DARK MARKINGS OF TORNUS DIFFUSE
♂: AEDOEAGUS TUBULAR, DISTINCT, ANELLUS VESTIGIAL
♀: T.9 ENTIRE
BISTRIGULELLA BRAUN
1 PREAPICAL AND 1 POSTAPICAL CHEVRON SHAPED STRIGIL
♂: AEDOEAGUS WITHIN FLUTED ANELLUS
GROUP II
FRONT WING WITH ONLY A DORSAL SPOT
MALE GENITALIA:
PECTINIFERS LARGE
SOCII SEPARATE
SACCUS NORMAL
FEMALE GENITALIA:
OSTIUM PADS PRESENT
APOPHYSES LONG
CRETEA MEYR
TORNUS MARKINGS: 2-3 CHEVRON-SHAPED BARS
♂: AEDOEAGUS WITHIN SPEAR-SHAPED ANELLUS
♀: T.9 BILOBED, OSTIUM PADS REMOTE
QUADRISTRIGELLA CHAM.
TORNUS MARKINGS: 4 NARROW STRIGILS
♂: AEDOEAGUS WITHIN BIFID ANELLUS
♀: OSTIUM PADS CONTIGUOUS, DIVERGENT
ALBOGALLERIELLA CLEM.
TORNUS MARKINGS: 0-3 NARROW STRIGILS
♂: AEDOEAGUS WITHIN SPATULATE ANELLUS
♀: OSTIUM PADS APPROXIMATE, PARALLEL

Male genitalia. — Central process of anellus spear shaped; socii 1½ to 2 times as long as broad.

Female genitalia. — Ostium pads longer than broad and separated by approximately the distance of their length.

Opostega quadristrigella Chambers.

Anterior wing with two parallel or slightly divergent costal strigils separated by several series of distinctly white scales, a third strigil below them in the posterior fringe and a fourth less distinct strigil in the apical fringe. Dorsal spot usually gray. Posterior wings gray. In melanistic specimens all or part of the front wing is overlaid with gray scales.

Male genitalia. — Tip of central process of anellus bifid. Socii approximately as broad at base as their length and narrowing apically.

Female genitalia. — Ostium pads short and broad, inner margins contiguous at base and diverging apically.

Opostega albogalleriella Clemens.

Anterior wing with two divergent strigils in the costal margin of the tornus and one in the fringe beyond the apical dot. In some examples any or all of these were absent. Such variants conform closely with Chambers' description of *nonstrigella* and since his types can not be located these two may be conspecific. Dorsal spot small; sometimes absent. Hind wings white or slightly yellow.

Male genitalia. — Tip of central process of anellus spatulate; posterior margin rounded and smooth on inner surface.

Female genitalia. — Very similar to *O. quadristrigella* Cham. Ostium pads and ninth tergite more slender.

Opostega bistrigulella Braun.

Anterior wing with two distinct fuscous strigils between apical spot and costal fringe and two less distinct, more diagonal strigils extending into the posterior (dorsal) fringe. The area of scales and cilia between these strigils is whiter than the remainder of the wing. This is the largest of the North American species, having a wing expanse of 12-15 mm. in comparison with 6-10 mm. for the others.

Male genitalia. — Central process of anellus spatulate, flattened and longitudinally ridged or fluted on inner surface. Distal process of sacculus broad and thumb-shaped.

Female genitalia. — No females were found in any of the collections examined.

ACKNOWLEDGMENTS

The author wishes to acknowledge the generous loan of specimens for dissection from the educational institutions mentioned in paragraph 1, from the private collections of Dr. ANNETTE F. BRAUN and CHARLES P. KIMBALL and to the U. S. National Museum and Philadelphia Academy of Sciences for the privilege of examining type material. The writer is also grateful to Dr. ANNETTE F. BRAUN, Dr. W. T. M. FORBES, Dr. RONALD HODGES, and Dr. ALEXANDER B. KLOTS for advice and assistance in the interpretation of the structure of male and/or female genitalia.

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BUTTERFLY MIGRATION

September draws them through her sunny skies
Along the magic wave line of the shore,
Those feathered dreams that men call butterflies,
To honey cups not known to them before.
Their veined but fragile wings do not display
The strange endurance furthering their flight.
Unhampered by the subtle breeze each day
They hover over meadows and alight
In mass communion, quaffing of the mead
That gives them strength for yet another mile,
Forming bouquets on each enticing weed
Which lends itself as altar for a while,
Then flutter on, their tattered wings the toll
Of constant struggle toward the longed for goal.

KATHERINE HUNN KARSNER

Westtown, Penna., U. S. A.

ESPECIALLY FOR FIELD COLLECTORS

(Under the supervision of FRED T. THORNE, 1360 Merritt Dr., El Cajon, Calif., U.S.A.)

FIELD OBSERVATIONS ON THE RARE ARGYNNID, *SPEYERIA EGLEIS TEHACHAPINA*

by JOHN F. EMMEL and THOMAS C. EMMEL

Up to the publication of COMSTOCK's *Butterflies of California* in 1927, the southern Californian race *tehachapina* Comstock of *Speyeria egleis* was known only from the four type specimens, collected in mid-July, 1918. Since that time, a few collectors have roamed the high elevations of the Tehachapi Mountains (type locality) and have been moderately successful in obtaining more examples of this lightly marked, almost unsilvered race. During 1962 we made a special trip to the type locality and surrounding areas to make observations on the ecology of this rare argynnid and collect a series of adults.

Leaving Los Angeles early on the morning of July 20, 1962, we followed U. S. Highway 6 to the town of Mojave in Kern County. At Mojave we turned west along Oak Creek Road and after traveling 10.3 miles, took a road heading southwest along Oak Creek. But here we learned from a rancher that the type locality area we wished to visit – Double Mountain – was closed to entrance on the south face because of fire hazard. Thus we were forced to retrace our steps and go northwest to the town of Tehachapi, where it was possible to get close to Double Mountain by driving along Water Canyon Road to Tehachapi Mountain Park, a good camping spot just north of this highest peak of the Tehachapis.

In Tehachapi Mountain Park itself, collecting along the creek in the late morning turned up some interesting species: *Papilio multicaudatus* Kirby, *P. rutulus* Lucas (with one specimen which appears to be a hybrid between these two *Papilio* species), abundant *Neophasia menapia* Felder & Felder fluttering about the pines, *Pieris protodice* Linnaeus, *Danaus plexippus* Linnaeus, swarms of *Cercyonis sthenele silvestris* Edwards, many ovipositing females of *Speyeria callippe macaria* Edwards, *Phyciodes mylitta* Edwards, a few *Polygonia satyrus* Edwards, *Satyrium saepium* Boisduval, *S. dryope* Edwards, *Lycaena arota*

Boisduval, *L. xanthoides* Boisduval, *Plebejus acmon* Westwood & Hewitson, and many *Leptotes marina* Reakirt.

After noon, we hiked directly south from the Park and began to ascend the northern peak (locally known as Mt. Tehachapi, elevation 7986 feet) of Double Mountain. It required two hours to attain the peak. Along the way we collected or observed *Limenitis bredowii* Geyer, large numbers of the hairstreak *Habrodais grunus* Boisduval, and an occasional *Speyeria callippe macaria; Plebejus neurona* Skinner was found along the ridges, always in close association with its foodplant, *Eriogonum wrightii.*

When the highest ridge (which runs east from the peak of Mt. Tehachapi for approximately a mile before dropping off steeply) was reached, we sighted the first specimen of *tehachapina* – a male in somewhat worn condition. During the remainder of that afternoon, fifteen males and one lone (but fresh) female were taken. We were puzzled over the apparent absence of females, in view of the well-worn condition of several male specimens; the reason for this absence was discovered the next day. But we had a good opportunity to note some of the characteristic habits of the males.

S. tehachapina was easily distinguished in flight from *S. macaria* by its darker coloration and slightly more erratic, rapid flight. When frightened by the collector, *tehachapina* would always fly downhill; otherwise, the males were found only at the very top of the ridge. These adults occasionally visited the flowers of *Chrysothamnus nauseosus* and a low-growing, yellow-flowered species of *Eriogonum,* at which time they were easily netted.

The next morning (July 21) we again scaled the mountain in hopes of finding more females. It was then that we discovered that the flight activity of the females differed markedly from that of the males in this locality.

Along the sides of the high ridge we were scouting, many pine trees had been felled by lumbermen. In the clearings formed in this manner, among the fallen logs, we found freshly emerged females fluttering in weak flight. Twenty females and several more males were collected within six hours, to bring our total two-day catch to twenty-one pairs.

Thus we felt fortunate in being among the few lepidopterists who have found this rare butterfly during its mid-July flight period, and we planned then to return in a future season to attempt to locate the foodplants and obtain the life history of the insect.

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MORE OREGON RECORDS OF *SATYRIUM BEHRII*

Mr. CLENCH seems to have stirred a hornet's nest in the EHRLICHS' latest book by the announcement that *Satyrium behrii* Edwards strangely did not occur in Oregon. Thus, having recently been assigned to the Burns Weather Bureau within the *Artemisia tridentata* and *A. t. arbuscula* (Sagebrush) area of southwestern Oregon, I kept alert for the appearance of *S. behrii.* The following are from my records: (1) 21.VII.63 (5♂♂, 1♀), and 2.VIII.63 (2♂♂), from Cricket Creek, Ochoco National Forest road No. 2033, 13 miles NW of Burns (sec.6 Ran.29E Twn.20S), elev. 4600′, Harney Co., Oreg. (this area is now badly trampled by range cattle); (2) 23. VII. 63 (4♂♂, 3♀♀, one set taken *in copula*), from the Silvies River Dam, 5 miles NE of Burns (sec.23 Ran.30E Twn.22S), 4200′, Harney Co., Oreg. (this is a swampy area with abundant *Solidago* sp.); (3) 26.VII.63 (1♂, 2♀♀), from 3 miles SE of Eagle Rock, State Hy. 380, on the Crooked River (sec.17 Ran.18E Twn. 16S.), elev. 3270′, Crook Co., Oreg. (This locality is along a willow-infested riverbank); (4) 1.VIII.63 (1♂), from Devine Canyon on Timmer Ck., 10 miles N of Burns (sec.27 Ran.31E Twn.21S), elev. 5036′, Harney Co., Oreg. (This locality is the only one where *Lupinus* sp. was noted).

I take the liberty of quoting the following records from the collection of STANLEY S. JEWETT, JR., of Portland: 18.VII.59 (5♂♂, 4♀♀), and 10.VII.52 (4♂♂, 1♀), from Camp Sherman, 15 miles NW of Sisters, Jefferson Co., Oreg. Of interest also, due to its proximity, is his record of 18.VI.59 (1♂, 1♀), near mouth of Wildhorse River, Adams Co., Idaho.

In all cases, my catches of *S. behrii* were taken visiting Goldenrod (probably *Solidago gigantea*), where usually *Callophrys spinetorum,* worn *C. nelsoni,* and *Satyrium californica* were nearby on the same bush. The insects were not easily distrubed from the flower, it often being necessary to shake the blossoms to force them to go into the net. The brownish *behrii* were easily identified and netted on the yellow blossoms.

Specimens have been sent to J. W. TILDEN and H. K. CLENCH for distribution. Perhaps soon now collectors in Montana and Arizona will find *behrii* as common as it appears to be in Oregon. As TILDEN indicated, it is most likely due to lack of collecting in these areas that makes certain species appear to be scarce.

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Journal of the Lepidopterists' Society:

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RECENT LITERATURE ON LEPIDOPTERA

Under this heading are included abstracts of papers and books of interest to lepidopterists. The world's literature is searched systematically, and it is intended that every work on Lepidoptera published after 1946 will be noticed here. Papers of only local interest and papers from this *Journal* are listed without abstract. Readers, not in North America, interested in assisting with this very large task, are invited to write Dr. P. F. BELLINGER (Dept. of Natural Sciences, San Fernando Valley State College, Northridge, Calif., U. S. A.). Abstractors' initials are as follows:

[P.B.] – P. F. BELLINGER	[W.H.] – W. HACKMAN	[N.O.] – N. S. OBRAZTSOV
[I.C.] – I. F. B. COMMON	[T.I.] – TARO IWASE	[C.R.] – C. L. REMINGTON
[W.C.] – W. C. COOK	[J.M.] – J. MOUCHA	[J.T.] – J. W. TILDEN
[A.D.] – A. DIAKONOFF	[E.M.] – E. G. MUNROE	[P.V.] – P. E. L. VIETTE

F. BIOLOGY AND IMMATURE STAGES

Ulyett, G. C., "Host adoption by hymenopterous parasites." *Journ. ent. Soc. southern Africa,* vol.9: pp.236-237. 1947. Native South African parasites have "adopted" the introduced *Plutella maculipennis* and *Carpocapsa pomonella.* [P. B.]

Ulyett, G. C., & J. S. v. d. Merwe, "Some factors influencing population growth of *Ephestia kühniella* Zell. (Lep., Phycitid.)." *Journ. Ent. Soc. southern Africa,* vol.10: pp.46-63, 5 figs. 1947. Discussion of composition of food (mixed flour and bran), effects of competition, relationship between size and fecundity; mechanism of adjustment of population density with constant food supply is described. [P. B.]

Umnov, M. P., "The Fall Webworm (*Hyphantria cunea* Drury) – new pest of plants in Europe" [in Russian]. *Zool. Zhurn.,* vol.34: pp.1292-1314. 1955. [Not

Underhill, G. W., "Some 1944-1949 notes on the Sycamore Leaf Roller (*Anchylopera platanana* Clem.) and its control." *Virginia Journ. Sci.,* vol.1: p.333. "1950" [1951]. Abstract.

Urbahn, E., "*Zeuzera pyrina* L. in *Viscum album* L." [in German]. *Zeitschr. Lepid.,* vol.2: p.120. 1952. Adult emerged from mistletoe (growing on Black Poplar). [P. B.]

Uspenskria, N. V.., "Biology and economic importance of the Snout Moth (*Euzophera bigella* Zell.)" [in Russian]. *Trudy Inst. Zool. Parasitol. Akad. Nauk Uzbekskoi SSR,* vol.1: pp.188-190. 1953. [Not seen].

Vago, Constantin, "Septicémie à spirochètes chez les 'vers courts' de *Bombyx mori* et son role dans l'étiologie de cette maladie" [in French]. *Bull. Soc. zool. France,* vol.75: pp.201-206. 1950. Describes symptoms of secondary infection in silkworm larvae. [P. B.]

Vago, C., "Existence d'une pseudo-muscardine d'origine saprophytaire et les conséquences de ce fait pour la sériciculture" [in French]. *Acta tropica,* vol.8: pp.360-362, 1 fig. 1951. Describes fungal disease of *Bombyx mori.* [P. B.]

Vago, Constantin, "Identité des agents des momifications saprophytaires blanchâtre et brune des chenilles de lépidoptère" [in French]. *Rev. Mycol.,* vol.16: pp.33-35, 1 fig. 1951. Fungus attacking caterpillar corpses; apparently not parasitic. [P. B.]

Vago, C., "Le role des microbes de l'intérieur des oeufs d'insectes en vue de l'emploi de ces derniers comme milieux vivants" [in French]. *Bull. Soc. Hist. nat. Toulouse,* vol.86: pp.252-258. 1951. Records bacteria in eggs of *Bombyx mori* & *Saturnia pyri.* [P. B.]

Vago, C., "Polyédrie du *Bombyx mori* L. aux symptômes atypiques" [in French]. *Bull. Soc. ent. France,* vol.56: pp.108-111. 1951. Describes virus disease of larvae, histologically identical with "*grasserie*" but with different external symptoms. [P. B.]

Vago, C., "Enchaînement d'une virose et d'une septicémie bactérienne chez les larves de *Thaumatopoea pityocampa* Schiff." [in French]. *C. R. Soc. Biol.*, vol.148: pp.1993-1995. 1954. Combined infection with *Bacterium paracoli* and the virus *Borrelina.* [P. B.]

Vago, C., "Actions virusales indirectes" [in French]. *Entomophaga,* vol.1: pp.82-87, 1 fig. 1956. Reports synergistic effect of virus infections, increasing mortality rate due to other causes, in larvae of *Bombyx mori* and other Lepidoptera. [P. B.]

Vago, C., & J. Nicot, "Contribution à l'écopathologie comparée des mycoses à propos d'une nouvelle affection du lépidoptère *Bombyx mori* L." [in French]. *Rev. Mycol.,* vol.19: pp.255-261. 1954. Describes a disease caused by *Fusarium moniliforme.* [P. B.]

Vago, C., & L. Vasiljevic, "Une virose à localisation intestinale avec affinité cytoplasmique chez le lépidoptère *Thaumatopoea processionea*" [in French; German summary]. *Antonie van Leeuwenhoek,* vol.51: pp.210-214, 1 fig. 1955.

Vallins, F. T., "*Ecliptopera silaceata* Schiff. feeding on Yellow Balsam." *Ent. Gaz.,* vol.1: p.127. 1950. New foodplant, *Impatiens noli-me-tangere.* [P. B.]

Van Denburg, D. O., "The Orange Striped Oak Caterpillar (*Anisota senatoria*). A defoliator of oak." *Penn. Forests & Waters,* vol.4: pp.102-103, 4 figs. 1952.

Various authors, "Notes and exhibitions." *Proc. Hawaiian ent. Soc.,* vol.14: pp.343-370. 1952. Includes record of *Amorbia emigratella* on *Cassia leschenaultiana;* records of parasites bred from *Hymenia* & some destructive noctuids; *Stenoptilia parva* new to Hawaii. [P. B.]

Various authors, "Notes and exhibitions." *Proc. Hawaiian ent. Soc.,* vol.15: pp.1-20. 1953. Including parasite records from *Scotorythra caryopis, Ephestia cautella,* & *Vanessa cardui; Phyllocnistis citrella* & *Papilio xuthus* bred from *Cordia subcordata.* [P. B.]

Various authors, "Notes and exhibitions." *Proc. Hawaiian ent. Soc.,* vol.15: pp.263-291. 1954. Includes records of *Prays* sp. feeding on *Pelea, Anacamptodes fragilaria* on broccoli, *Spilonota holotephras* on guava; also parasites of *Plutella, Bedellia,* & *Cactoblastis cactorum.* [P. B.]

Various authors, "Notes and exhibitions." *Proc. Hawaiian ent. Soc.,* vol.15: pp.373-390. 1955. Including record of *Achaea janata* on *Schinus terebinthifolius;* parasites of *Laphygma exempta, Spodoptera mauritia, Cactoblastis cactorum,* & *Ethmia colonella.* [P. B.]

Various authors, "Notes and exhibitions." *Proc. Hawaiian ent. Soc.,* vol.16: pp.1-19. 1956. Includes new parasite record from *Omiodes accepta,* & notes on damage to cactus by *Cactoblastis cactorum.* [P. B.]

Vasic, Konstantin, "Contribution à la connaissance de la morphologie et de la biologie d'*Euxoa aquilina* Schiff." [in Serbian; French summary]. *Acad. serbe Sci. XXXI, Inst. Ecol. Biogeogr.* no.4: pp.185-208, 2 pls. 1953. All stages described in detail; good characters found in pectinations of antennae. In captivity isolated pairs of *E. aquilina* & *E. temera* will not copulate, but mating is easily obtained with crowding. All related Serbian *Euxoa* figured; reproduction of figs. poor. [C. R.]

Vasiljević, Lj., "Les recherches sur la pathologie de l'écaille fileuse (*Hyphantria cunea* Dr.) en Yougoslavie" [in French]. *Entomophaga,* vol. 1: pp.98-100, 1 fig. 1956. Report on lethality of *Bacillus* spp. to larvae. [P. B.]

Veber, J., "A cytoplasmic polyhedral disease of the Gypsy Moth (*Lymantria dispar* L.)." *Nature,* vol.179: pp.1304-1305, 3 figs. 1957. Naturally occurring pathogen, also infective to other Lepidoptera. [P. B.]

van der Vecht, J., "Parasitism in an outbreak of the coconut moth (*Artona catoxantha* (Hamps.) in Java (Lep.)." *Ent. Berichten,* vol.15: pp.122-132, 2 figs. 1954. Interesting analysis of intensity of parasitization & influence of parasites in controlling outbreak. Reduction in vigor of *Artona* population, with decrease in number of ♀♀, developed toward end of outbreak. [P. B.]

Venugopal, S., "*Tarache nitidula* F., a semilooper pest on cotton in south India." *Journ. Bombay nat. Hist. Soc.,* vol.54: pp.207-210, 1 pl. 1956. Describes all stages; lists alternate foodplants. [P. B.]

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Vogel, W., J. Klingler, & Th. Wildbolz, "*Pamene rhediella* Clerck, der Bodenseewickler, ein bisher übersehener Obstschädling" [in German]. *Mitt. schweiz. ent. Ges.*, vol.29: pp.283-301, 10 figs. 1956. Biology & control of this pest of fruit trees. Gives distinguishing characters of larva; records 2 parasites. Also records *P. argyrana* & *P. spiniana* from fruit trees. [P. B.]

Voukassovitch, P., "Contribution à l'étude de *Lymantria dispar* en 1949" [in Serbocroatian; French summary]. *Bull. Mus. Hist. nat. Pays serbe,* vol. 3/4: pp.273-291, 5 figs. 1950. Mainly on importance of larvaevorid flies in controlling outbreak. [P. B.]

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Wakely, S., "Notes on *Ethmia bipunctella* Fabr. and *E. terminella* Fletcher." *Proc. Trans. south London ent. nat. Hist. Soc.,* 1951-52: pp.144-145, 1 pl. 1952. Notes on biology (both feed on *Echium vulgare*); figures various stages & ♀ genitalia. [P. B.]

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Wakely, S., "Notes on *Coleophora salicorniae* Wocke." *Ent. Rec. & Journ. Var.*, vol.67: pp.192-193. 1955. Notes on biology & distribution in England. [P. B.]

Wakely, S., "Notes on *Isophrictis tanacetella* Schrank." *Ent. Rec. & Journ. Var.*, vol.69: pp.257-258. 1957. Reared from dead seed heads of *Tanacetum.* [P. B.]

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Warnecke, G., "Zur Frage der überwinterung von *Plusia gamma* L. in Nordwestdeutschland" [in German]. *Bombus,* no.36: pp.158-159. 1947. Species winters in all stages, but not as larva in north Germany. [P. B.]

Warnecke, Georg, "Einiges über *Graellsia isabellae* Graells (Lep. Saturn.)" [in German]. *Ent. Nachrichtenbl.*, Burgdorf, vol.2: pp.60-61. 1948. Foodplant *Pinus silvestris,* not *P. maritima.* Summarizes distribution. [P. B.]

Warnecke, Georg, "Etwas über den Matterhorn-Bär, *Arctia* (*Orodemnias*) *cervini* Fallou (Lep. Arct.)" [in German]. *Ent. Nachrichtenbl.*, Burgdorf, vol.3: pp.97-98. 1949. Notes on habitat & biology of this very local high alpine sp. [P. B.]

Warnecke, Georg, "Die Futterpflanzen der Raupe von *Taeniocampa gracilis* F." [in German]. *Mitt. Faunist. Arbeitsgem. Schleswig-Holstein,* vol.9: p.34. 1956. Polyphagous larva; records numerous foodplants. [P. B.]

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Weidner, Herbert, "Die Insekten der 'Kulturwüste' (Vorarbeiten zu einer Ökologie der Grossstadt)" [in German]. *Mitt. hamburg. zool. Mus. Inst.*, vol.51: pp.89-173. 1952. Study of insects assaciated with civilization in large cities such as Hamburg; includes 29 Lepidoptera (mainly spp. living or wintering in houses). [P. B.]

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Weiser, Jaroslav, "Klíč k určování mikrosporidií" [in Czech]. *Acta Soc. Scient. Nat. Moravicae,* vol.18: pp.1-64, 9 pls. 1947. Key to the genera & spp. of Microsporidia; for spp. found as parasites in Lepidoptera, see pp.33-36. [J. M.]

Weiser, Jaroslav, "Zur systematischen Stellun der Schizogregarinen der Mehlmotte, *Ephestia kuehniella* Z." [in German]. *Arch. Protistenk.*, vol.100: pp.127-142, 3 pls. 1954. Life cycle of *Mattesia dispora,* also found in *Plodia;* notes on *M. povolnyi* from *Homoeosoma nebulellum.* [P. B.]

Weiser, Jaroslav, "*Neoaplectana carpocapsae* n. sp. (Anguillulata, Steinernematinae), ein neuer Schmarozer des Apfelwicklers, *Carpocapsa pomonella* L." [in Czech; Russian & German summaries]. *Acta Soc. zool. Bohemoslav.*, vol.19: pp.45-52, 11 figs. 1955. Describes new worm parasite of larvae of *C. pomonella* and gives survey of nematode genus *Neoaplectana* with hosts (mainly Lepidoptera). [J. M.]

Weiser, Jaroslav, "Die Krankheiten des Tannentriebwicklers, *Cacoecia murinana* Hb. in der Mittelslowakei (ČSR)" [in German; English summary]. *Zeitschr. Pflanzenkrankh.*, vol.63: pp.193-197, 3 figs. 1956. Records 7 microorganisms causing disease in this tortricid (viruses, bacteria, Protozoa). [P. B.]

Weiser, Jaroslav, "Protozoäre Infektionen im Kampfe gegen Insekten" [in German; English summary]. *Zeitschr. Pflanzenkrankh.*, vol.63: pp.625-638, 6 figs. 1956. General discussion of Protozoa, particularly Microsporidia, as insect pathogens. Records protozoan parasites of various harmful Lepidoptera. [P. B.]

Weiser, Jaroslav, "Unsere Ergebnisse in der Erforschung der Krankheiten der Insekten" [in Czech; Russian & German summaries]. *Acta Soc. ent. Čechosloveniae*, vol.52: pp.61-76. 1956. List of diseases of insects in Czechoslovakia; discusses 28 spp. of Lepidoptera. [J. M.]

Weiser, Jaroslav, "Mikrosporidien des Schwammspinners und Goldafters" [in German; English summary]. *Zeitschr. angew. Ent.*, vol.40: pp.509-521, 6 figs. 1957. Pathogens of *Lymantria dispar* & *Nygmia phaeorrhoea*. [P. B.]

Weiser, Jaroslav, & Jaroslav Weber, "Die Mikrosporidie *Thelohania hyphantriae* Weiser des weissen Bärenspinners und anderer Mitglieder seiner Biocönose" [in German; English summary]. *Zeitschr. angew. Ent.*, vol.40: pp.55-70, 7 figs. 1957. Describes biology of parasite of *Hyphantria cunea, Nygmia phaeorrhoea, Yponomeuta malinella,* & *Malocosoma neustria*. [P. B.]

Weismann, L., & J. Jasič, "Beitrag zur Bionomie der Rubenmotte (*Gnorimoschema ocellatellum* Boyd)" [in Slovak; Russian & German summaries]. *Biológia*, Bratislava, vol.10: pp.604-612. 3 figs. 1955. Biology described. [J. M.]

Weisman, Ludovít, & Ján Jasič, "Beitrag zur Bionomie der Rubenmotte (*Gnorimoschema ocellatellum* Boyd) II." [in Slovak; German & Russian summaries]. *Biológia*, Bratislava, vol.11: pp.32-46. 1956. Life history of this sp. in S. Slovakia discussed. [J. M.]

Weiss, Harry B., & William M. Boyd, "Insect feculae, II," *Journ. New York ent. Soc.*, vol.60: pp.25-29. 1952. Describes feces of 9 spp. of Lepidoptera. [P. B.]

Wellenstein, Gustav, "Die Insektenjagd der Roten Waldameise (*Formica rufa* L.)" [in German]. *Zeitschr. angew. Ent.*, vol.36: pp.185-217, 6 figs. 1954. Numerous caterpillars are among prey of this ant. Those too large to be overpowered are eventually weakened by formic acid, and so killed. Spiny larvae, and especially those with long hair, give ants most difficulty. [P. B.]

Wellenstein, Gustav, "Was können wir von der Roten Waldameise im Forstschutz erwarten?" [in German]. *Beitr. Ent.*, vol.4: pp.117-138, 4 figs. 1954. Observations of predation by *Formica rufa* on various larvae of Lepidoptera. [P. B.]

Wellington, Eunice F., "Amino acids of two insect viruses." *Biochem. biophys. Acta*, vol.7: pp.238-243. 1951. Parasites of *Bombyx mori* and *Cacoecia murinana*. [P. B.]

Wellington, W. G., "Air-mass climatology of Ontario north of Lake Huron and Lake Superior before outbreaks of the Spruce Budworm, *Choristoneura fumiferana* (Clem.), and the Forest Tent Caterpilar, *Malacosoma disstria* Hbn. (Lepidoptera: Tortricidae; Lasiocampidae)." *Canad. Journ. Zool.*, vol.30: pp.114-127, 3 figs. 1952. *C. fumiferana* develops best in clear, dry weather, *M. disstria* in warm, humid, cloudy weather. Air-mass movements producing optimum conditions for these spp. are described. [P. B.]

Wenck, E., "Elevage d'hiver d'*Agrotis janthina*" [in French]. *Bull. Soc. ent. Mulhouse*, 1948: p.47. Reared in winter on cabbage & lettuce. [P. B.]

Wene, George P., & George Otey, "Insects injuring experimental plantings of flax and sesame." *Texas Journ. Sci.*, vol.8: pp.235-236. 1956. *Heliothis armigera, H. virescens*.

West, Oliver, "Larval parasite of *Dichapetalum cymosum*." *South Afr. Sci.*, vol.1: pp.68-69, 1 fig. 1947. Foodplant of *Sindris albimaculalis* (Pyralidae); plant poisonous to cattle. [P. B.]

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE NOTICE ON USE OF PLENARY POWERS

In accordance with a decision of the 13th International Congress of Zoology, 1948, public notice is hereby given of the possible use by the International Commission on Zoological Nomenclature of its plenary powers in connection with the following case, full details of which will be found in *Bulletin of Zoological Nomenclature*, Vol. 20, Part 6, published on 6 Dec. 1963.

Validation of a neotype for *Coenonympha ochracea* Edwards, 1861 (Insecta, Lepidoptera). Z. N. (S.) 1607.

Any zoologist who wishes to comment on this specific case should do so in writing, and in duplicate, as soon as possible, and in any case before 6 June 1964. Each comment should bear the reference number of the case. Comments received early enough will be published in the *Bulletin of Zoological Nomenclature*. Those received too late for publication will, if received before 6 June 1964, be brought to the attention of the Commission at the time voting begins.

All communications on the above subject should be addressed as follows:

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Cromwell Road,
LONDON, S. W. 7, ENGLAND.

W. E. CHINA

Acting Secretary to the International Commission on Zoological Nomenclature

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Contributions to the *Journal of the Lepidopterists' Society* may be on any aspect of the study and collection of Lepidoptera in any part of the world. Papers of more than twenty pages will not normally be accepted, but if they are, authors may be required to pay for overage.

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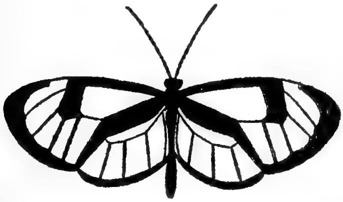

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13 May 1964

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Membership in the Society is open to all persons interested in any aspect of lepidopterology. All members in good standing receive the *Journal* and the *News of the Lepidopterists' Society*. Institutions may subscribe to the *Journal* but may not become members. Prospective members should send to the Treasurer the full dues for the current year, together with their full name, address, and special lepidopterological interests. All other correspondence concerning membership and general Society business should be addressed to the Secretary. Remittance in dollars should be made payable to *The Lepidopterists' Society*. There are three paying classes of membership:

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The Lepidopterists' Society is a non-profit, scientific organization. The office of publication is New Haven, Connecticut (see address inside back cover). Application for Second-class mail privileges has been approved at New Haven, Connecticut.

JOURNAL OF
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EVALUATION OF AN INSECT LIGHT TRAP DESIGNED TO SEPARATE BEETLES AND MOTHS[1]

by H. A. DENMARK

Entomology Section, Fla. Dept. Agrig., Gainesville, Florida

Insect light traps have been used for over 80 years for collection, population and migration studies, as a survey tool, and in attempts to control insects (Frost, 1952). Comstock (1879) and Riley (1885) described several light traps that were used for the control of the cotton leaf-worm (*Alabama argillacea* (Hübn.)). Evans (1907) and Banks (1909) tested light traps for collecting nocturnal insects. The New Jersey light trap, developed about 1931 is still used today to sample mosquito populations.

Many designs and light sources have been evaluated and the results reported. Reed, *et al.* (1935) designed a trap with a light source to attract the cigarette beetle (*Lasioderma serricorne* (Fab.)) and a fan to suck the beetles into a jar as a means of control. Weiss (1943) reported on the behavior of insects attracted to light of various wave lengths and color. The trap designed and reported on here resulted from the need to catch and separate beetles and moths.

The principle of this light trap is based on the habit of beetles flying against an object, folding their wings and dropping. Although the habits of moths are not as predictable, many species will land on the light trap and move upwards. Some species remain in place after being attracted to light while others make quick irregular flights and often fall short distances before recovering.

Design.— A 15-watt black light fluorescent lamp is mounted vertically inside a plastic cylinder 6 inches in diameter (Fig. 1). The cylinder is open at both ends with a metal baffle at the top and middle sections. The entrance to the inner canister is baffled, and a cone baffle is located

[1]Contribution No. 28, Entomology Section, Division of Plant Industry, Florida Department of Agriculture, Gainesville, Florida.

below the entrance. Four fin baffles extend vertically on four sides of the plastic cylinder. The large collection funnel contains a cone baffle to prevent insects from escaping once they fall into the funnel and to prevent direct entry of raindrops. The opening in the bottom of the outer canister permits rain water to drain. The top cover extends over the edge of the large collecting funnel, and the trap is hung in place by a hook in the center of the cover.

The inner canister is coated with plaster-of-Paris and saturated with ethyl acetate as a killing agent. The outer canister is filled with alcohol to the top of the drain. This trap will be referred to as a modified trap,

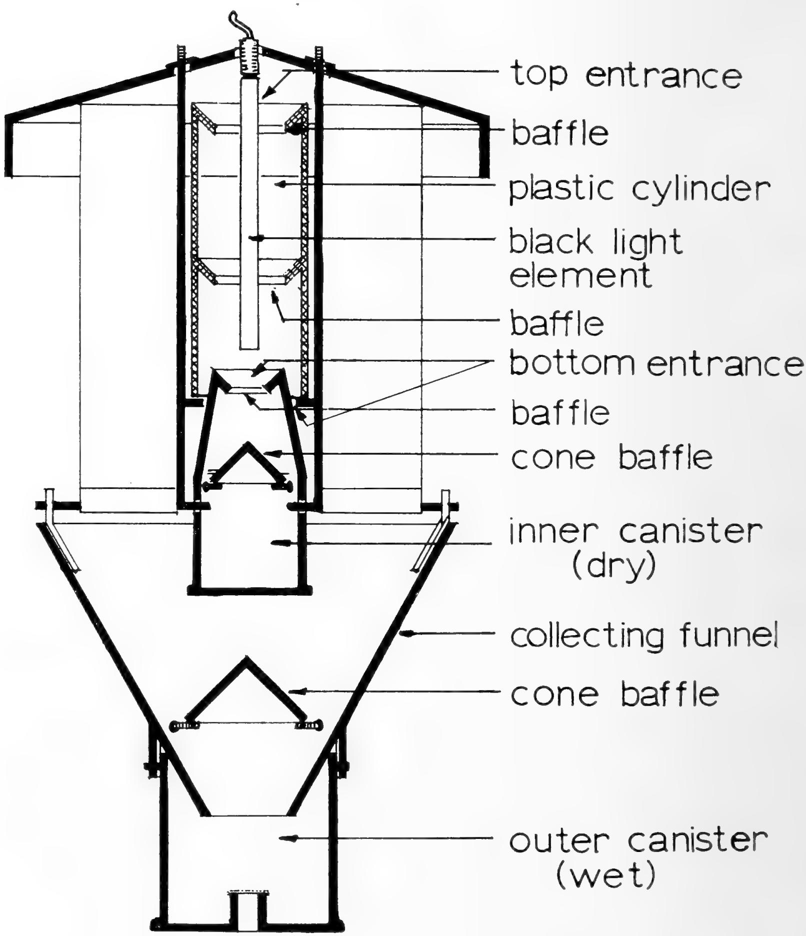

Fig. 1. Modified black light trap.

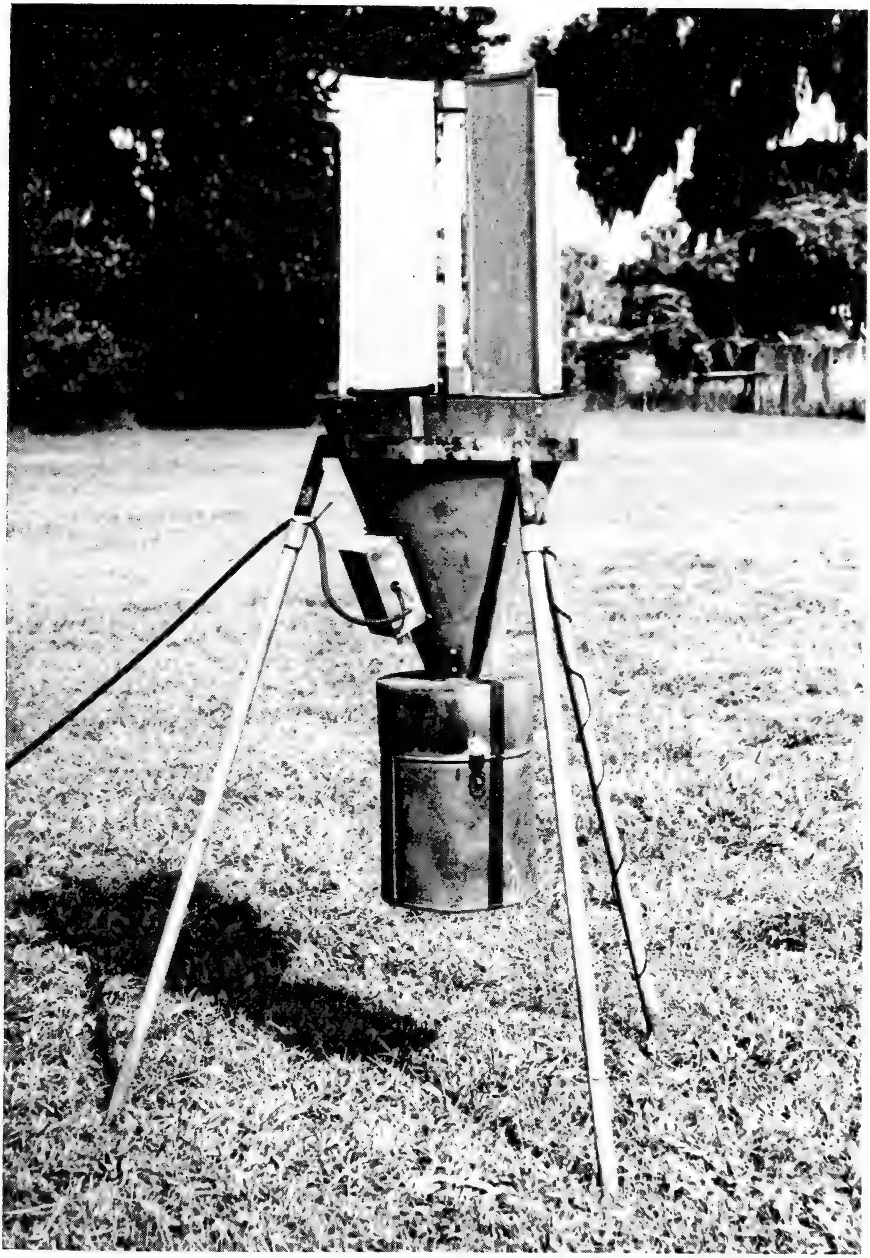

Fig. 2. Standard trap. Traps of this design have been furnished states participating in the Cooperative Economic Insect Survey by the Agricultural Research Service, Agricultural Engineering Research Division.

and the trap used to compare catches as the standard trap.

Several standard traps (Fig. 2) furnished by the United States Department of Agriculture, Agricultural Engineering Research Division, Agricultural Engineering Department, have been operated in various parts of Florida for the past 7 years. In Homestead, Belle Glade, and Sanford, the water beetle population is very high. If the insects are caught in a dry canister, the beetles destroy the moths before the beetles are killed. The beetles then become coated with moth scales making them unfit for collections and difficult to identify. If the insects are killed in alcohol, the moths are often ruined and the beetles are also coated with scales from the moths.

The standard and modified traps were operated at Gainesville, Florida

TABLE 1

DATE	MODIFIED TRAP				STANDARD TRAP
	Laphygma frugiperda		Coleoptera		
	Dry	Wet	Wet	Dry	Dry
7/19/62	14	23	81	0	43
7/20/62	15	23	103	0	46
7/21/62	3	6	47	0	14
7/22/62	10	13	84	1	25
7/23/62	12	17	92	0	34
7/24/62	10	18	101	0	41
7/25/62	10	13	123	2	24
8/1/62	10	14	96	0	26
8/2/62	16	41	112	1	48
8/3/62	20	78	136	2	82
8/4/62	20	46	127	0	63
8/5/62	6	17	84	1	36
8/6/62	6	24	91	0	41
8/7/62	6	9	87	0	30
9/1/62	4	6	83	1	7
9/2/62	6	6	111	1	15
9/3/62	9	13	86	0	15
9/4/62	10	14	74	0	23
9/5/62	13	15	97	0	25
9/6/62	17	15	103	1	29
9/7/62	11	12	127	2	36
TOTALS	228	423	2,045	12	703
AVE.	10.9	20.1	97.4	.5	33.4

Average combined catches of modified trap are 0.92 as great as the standard catch and the modified dry catch is 0.5 as great as the wet catch.

to compare catches and to test the efficiency of the modified trap to separate moths and Coleoptera. Six species of moths common to the area were selected arbitrarily for the comparisons; all six are noctuids.

Results.— An average of less than one Coleoptera was caught in the inner canister. Occasionally a Coleoptera would alight on the plastic cylinder, crawl up the side, and fall into the inner canister (Tables 1-6). Large numbers of Coleoptera were caught in the outer canister of both the modified trap and the standard trap.

The average standard trap catch was approximately as many moths as the combined average catch of the modified trap. The ratio of the number of moths caught in the inner canister as opposed to the outer canister of the modified trap ranged from 0.5:1 to 1:1, respectively (Tables 1-6).

TABLE 2

DATE	MODIFIED TRAP				STANDARD TRAP
	Agrotis subterranea		Coleoptera		
	Dry	Wet	Wet	Dry	Dry
7/19/62	10	13	81	0	17
7/20/62	5	14	103	0	16
7/21/62	4	6	47	0	10
7/22/62	4	13	84	1	17
7/23/62	4	6	92	0	9
7/24/62	12	16	101	0	18
7/25/62	4	11	123	2	14
8/1/62	2	6	96	0	11
8/2/62	10	11	112	1	14
8/3/62	10	15	136	2	18
8/4/62	12	17	127	0	19
8/5/62	13	16	84	1	26
8/6/62	11	17	91	0	24
8/7/62	11	18	87	0	26
9/1/62	10	16	83	1	21
9/2/62	11	15	111	1	24
9/3/62	15	21	86	0	29
9/4/62	11	11	74	0	13
9/5/62	10	11	97	0	17
9/6/62	11	14	103	1	18
9/7/62	11	10	127	2	15
TOTALS	191	277	2,045	12	376
AVE.	9.1	13.2	97.4	0.5	18

Average combined catches in the modified trap are greater than the standard catch and the modified dry catch is 0.7 as great as the wet catch.

TABLE 3

DATE	MODIFIED TRAP				STANDARD TRAP
	Heliothis zea		Coleoptera		
	Dry	Wet	Wet	Dry	Dry
7/19/62	11	13	81	0	24
7/20/62	10	14	103	0	18
7/21/62	11	13	47	0	17
7/22/62	11	11	84	1	14
7/23/62	12	16	92	0	24
7/24/62	19	16	101	0	31
7/25/62	42	73	123	2	97
8/1/62	17	18	96	0	32
8/2/62	10	20	112	1	23
8/3/62	12	15	136	2	18
8/4/62	11	17	127	0	31
8/5/62	16	22	84	1	29
8/6/62	17	18	91	0	27
8/7/62	10	15	87	0	28
9/1/62	28	40	83	1	58
9/2/62	12	13	111	1	16
9/3/62	11	15	86	0	25
9/4/62	14	16	74	0	29
9/5/62	10	19	97	0	22
9/6/62	11	12	103	1	15
9/7/62	11	11	127	2	13
TOTALS	306	407	2,045	12	591
AVE.	14.6	19.4	97.4	0.5	28.1

Average combined catches in the modified trap are greater than the standard catch and the modified dry catch is 0.75 as great as the wet catch.

Discussion.— Coleoptera and moths can be separated successfully by enclosing the black light element in a baffled plastic cylinder. The cylinder may reduce the numbers of moths caught in the inner canister as compared to the number caught in the outer canister (Tables 1-6). The number of Coleoptera caught in the inner canister was always low and occasionally a leafhopper or fly was caught also. Dr. Wallace C. Harding, Jr. reported high numbers of Cicadellidae and Diptera caught

TABLE 4

DATE	MODIFIED TRAP				STANDARD TRAP
	Mocis latipes		Coleoptera		
	Dry	Wet	Wet	Dry	Dry
8/20/62	18	10	137	2	21
8/21/62	15	12	129	3	16
8/22/62	12	10	131	0	13
8/23/62	14	14	124	0	16
8/24/62	10	11	96	1	12
8/25/62	13	12	106	0	12
8/26/62	14	11	89	0	15
9/1/62	13	11	83	1	15
9/2/62	14	17	111	1	16
9/3/62	14	18	86	0	24
9/4/62	19	29	74	0	40
9/5/62	20	26	97	0	44
9/6/62	19	21	103	1	40
9/7/62	15	22	127	2	39
10/1/62	31	17	81	0	36
10/2/62	14	30	74	0	19
10/3/62	7	19	78	1	42
10/4/62	13	15	66	0	48
10/5/62	16	19	73	0	39
10/6/62	18	18	81	1	43
10/7/62	11	21	74	1	42
TOTALS	320	363	2,020	14	592
AVE.	15.3	17.3	96	0.7	28.1

Average combined catches in the modified trap are greater than the standard catch and the modified dry catch is 0.88 as great as the wet catch.

in the inner canister of a modified trap he operated, located at Fairland, Maryland, 1961. His trap did not have the baffles on the inside of the plastic cylinder. Location of traps and differences in insect populations probably will effect the number of insects caught in the inner and outer canisters.

The evaluation of the modified trap as a survey tool to separate beetles and moths is difficult even when a single species is compared. There are

often wide ranges in the number of specimens caught on any two dates. The variation in numbers caught is also evident in the standard trap. Since most catches of the standard trap were about as great or greater than the modified trap, the plastic cylinder was tested to determine the effects, if any, on the wave length of the light source by Mr. James M. Stanley, Agricultural Engineer, United States Department of Agriculture, Blacksburg, Virginia. Figure 3 shows that the plastic cylinder transmitted more lower wave length energy than a 40-watt black light fluorescent

TABLE 5

DATE	MODIFIED TRAP				STANDARD TRAP
	Anticarsia gemmatilis		Coleoptera		
	Dry	Wet	Wet	Dry	Dry
8/20/62	11	11	137	2	16
8/21/62	10	11	129	3	18
8/22/62	8	11	131	0	17
8/23/62	12	10	124	0	19
8/24/62	11	12	96	1	16
8/25/62	11	11	106	0	21
8/26/62	9	12	89	0	24
9/1/62	13	12	83	1	19
9/2/62	13	16	111	1	26
9/3/62	11	14	86	0	28
9/4/62	21	16	74	0	37
9/5/62	17	7	97	0	31
9/6/62	14	12	103	1	27
9/7/62	16	15	127	2	32
10/1/62	13	12	81	0	29
10/2/62	13	19	74	0	21
10/3/62	17	18	78	1	37
10/4/62	11	16	66	0	36
10/5/62	19	7	73	0	34
10/6/62	16	16	81	1	37
10/7/62	12	15	74	1	31
TOTALS	278	273	2,020	14	556
AVE.	13.2	13.0	96	0.7	26.5

Average combined catches in the modified trap are equal to the standard catch and the modified dry catch is equal to the modified wet catch.

lamp. It is thought that the lower wave lengths attracted more insects; therefore, the difference in the catches for the standard and modified traps must be in the design rather than in light source. It would be desirable to separate all moths and beetles as they are attracted to a light trap. To date no light trap has been designed to do this. The modified trap discussed in this paper will separate about 50 per cent of some species of moths from beetles. For other species, however, it is not as efficient.

TABLE 6

DATE	MODIFIED TRAP				STANDARD TRAP
	Alabama argillacea		Coleoptera		
	Dry	Wet	Wet	Dry	Dry
8/20/62	11	11	137	2	24
8/21/62	11	13	129	3	27
8/22/62	12	12	131	0	25
8/23/62	12	11	124	0	24
8/24/62	11	11	96	1	23
8/25/62	10	12	106	0	22
8/26/62	11	12	89	0	24
9/1/62	12	12	83	1	26
9/2/62	12	11	111	1	24
9/3/62	11	10	86	0	23
9/4/62	10	11	74	0	21
9/5/62	11	12	97	0	24
9/6/62	10	10	103	1	21
9/7/62	11	11	127	2	23
10/1/62	10	10	81	0	21
10/2/62	12	12	74	0	24
10/3/62	14	18	78	1	37
10/4/62	15	20	66	0	43
10/5/62	10	11	73	0	29
10/6/62	12	12	81	1	20
10/7/62	12	12	74	1	26
TOTALS	240	254	2,020	14	531
AVE.	11.4	12.1	96	0.7	25.3

The average combined catches in the modified trap are 0.92 as great as the standard catch and the modified dry catch is 0.95 as great as the wet catch.

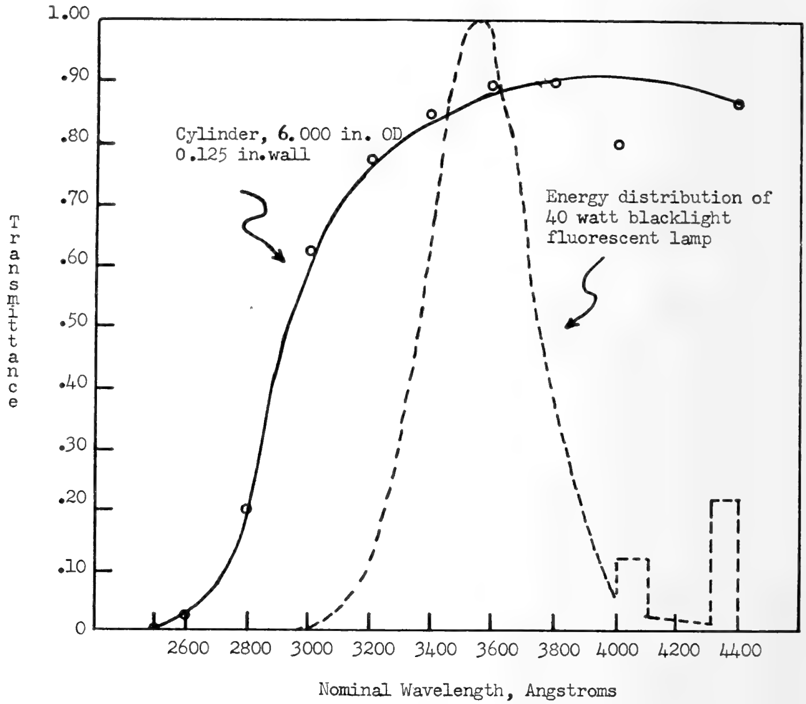

Fig. 3. A comparison of wave lengths of a 15-watt black light element through a 0.125 inch plastic cylinder and a 40-watt black light element.

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AN ANNOTATED LIST OF BUTTERFLIES COLLECTED IN BRITISH HONDURAS IN 1961

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During the late summer of 1961, I had the opportunity to spend nearly one month collecting butterflies in Central America's northern-most country, British Honduras. With the help of several faculty members at Louisiana State University and with the generous cooperation of the Forestry Commission of Belize, I was able to visit and lodge at two forestry camps in that country. The first camp, known as Augustine, is located in the country's western district, the Cayo District. The second camp known as Melinda, is located in the coastal Stann Creek District (fig. 1).

Information concerning the butterflies of British Honduras is very scanty as it is indeed for many tropical lands. Other than a few locality records in Godman & Salvin (1879-1901) and in Seitz (1923), the only work devoted to the butterflies of that country is by Davis (1928) who records 228 species as occurring there. The present survey adds 28 additional species to this (20 of which belong to the Lycaenidae and Riodinidae) bringing the total to 259 species. Probably 100 additional species are yet to be collected in this area.

All species collected will be discussed following a brief description of the two collecting sites. It should be stated here that comments referring to the abundance of the species are often based largely upon sight observations, few individuals actually having been captured. Those species marked with an asterisk represent new national listings.

AUGUSTINE

Augustine lies on the edge of a rolling pineland called the Mountain Pine Ridge which ranges in elevation from 1,000-3,000 feet above sea level. The actual camp is located at approximately 1,600 feet and receives an average annual rainfall of 65 inches.

Three basic types of forests occur within a relatively short distance of Augustine. First, pine forest surrounds the camp proper. *Pinus caribaea* M. forms an extensive stand here on the rather poor soil which tops the lower granite substrate. Several other trees, notably *Quercus barbeyana* T., *Q. hondurensis* T., *Clethra hondurensis* B., *Leucothoe mexicana* (S.) and *Byrsonima crassifolia* (L.) occur here also (Lundell, 1940). Due to the frequent fires which rage throughout this hilly region,

the undergrowth is kept low and is composed of various sedges and grasses, many of which belong to the genera *Polygala, Panicum,* and *Paspalum* (Standley & Record, 1936).

The second type of forest lies just west of the camp. This area ranges in altitude from approximately 1,200-1,500 feet. The soil is richer due to the limestone substrate. These conditions produce a more tropical or humid type of forest which is best termed a second growth succession due to its appearance subsequent to the abandonment of the corn fields or milpas. Trees average in height up to 40-50 feet and include the following species: *Cecropia mexicana* H., *Belotia campbellii* S., *Cordia alliodora* R. & P., *Ceiba pentandra* (L.), *Ochroma concolor* R., *Schizolobium parahybum* (V.) (Russell, 1962). Many of these same tree species are found in the numerous valleys and revines throughout the Pine Ridge section and the butterfly faunas are also very comparable.

The third type of forest lies still farther west of the camp and is actually

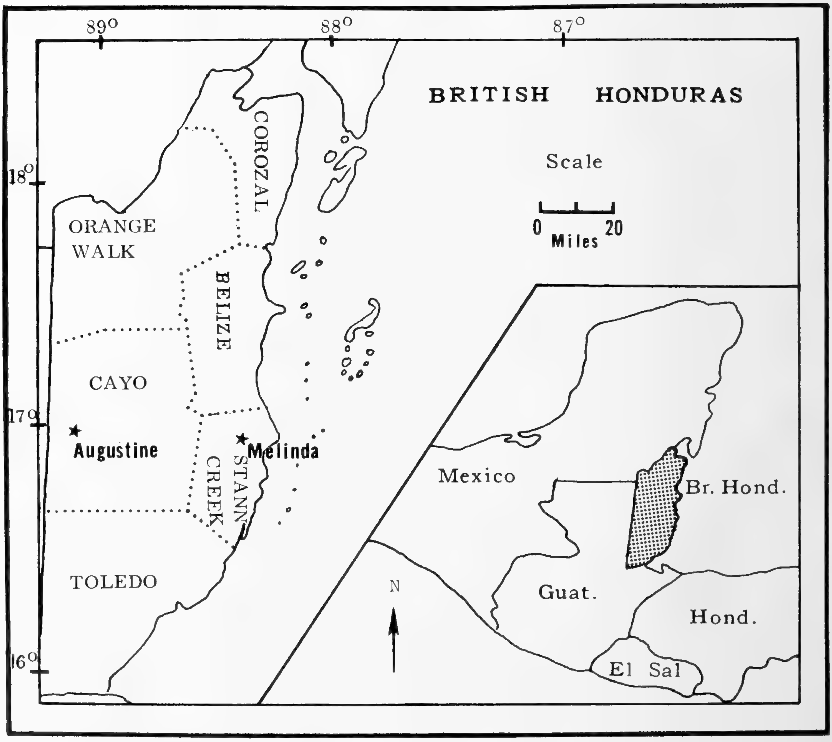

Figure 1. Map of British Honduras showing political districts, two collecting sites (Augustine, Melinda), and relationship of the country to Mexico and the remainder of Central America.

an encroachment from the Peten of Guatemala. This type can be termed an advanced forest, tall tropical forest, or rain forest. However, it is not a rain forest in the classic sense of the term because all forests throughout British Honduras experience a four-month dry season (February-May) and contain several deciduous species of trees. This forest is relatively undisturbed and trees reach a height of approximately 80-100 feet. Some of the common trees encountered in this type include *Swietenia macrophylla* K., *Calophyllum brasiliense* C., *Terminalia obovata* (R. & P.), *Nectandra globosa* (A.), *Aspidosperma megalocarpon* M., *Achras zapota* L. and *Dialium guianense* (A.) (Russell, 1962). The Cohune Palm, *Orbigyna cohune* (M.) forms a predominant species here.

During my stay at Augustine (August 12-29), I collected in all three of the forest types mentioned above. My total catch was 305 specimens representing 95 species.

Melinda

This camp is situated approximately eleven miles inland from the gulf coast and the city of Stann Creek. The rainfall is somewhat more abundant than at Augustine, the average being 102 inches annually (Standley & Record, 1936). The elevation is approximately 50 feet above sea level.

Melinda lies in the heart of the Middlesex Valley Agricultural Region and thus the surrounding forest is all of a secondary succession type containing many of the same species listed previously.

In addition to collecting in the immediate vicinity of Melinda, I made several excursions south into the pine savannah which lies on the coastal plain. This lowland pine forest (*Pinus caribaea* M.) contains large stands of the palmetto *Acoelorrophe wrightii* (G.). Also present are *Curatella americana* L., *Quercus olloides* C. & S., *Byrsonima crassifolia* (L.), *Rhynchospora barbata* (V.) (Russell, 1962).

During my stay at Melinda (August 30-September 4), I collected 62 specimens representing 38 species.

Annotated List of Specimens Collected

FAMILY PAPILIONIDAE

The four species of *Parides* listed below all exhibit a common behavioral pattern. They all fly in company of one another in localized colonies scattered throughout both the secondary and advanced forests. These colonies may be separated from each other by distances of one-half to one mile, depending on the extent of the forest. Furthermore, they were usually found in places where the forest trail was comparatively wide and clear, allowing the sunlight to reach the ground.

In such a colony, it appeared as if the individuals had a definite, preferred "flyway" which was actually a section of the trail from 40-60 feet in length. These insects would fly approximately 3-5 feet above the ground at a medium velocity along such a section of trail. They would never stray into the undergrowth except when they reached the boundaries of the "flyway". Then, they would zig-zag off into the shrubbery, make a small circle and begin flying along the trail once again, this time in the opposite direction. The factor which determined the boundaries of these flyways was not at all apparent; the trail beyond, at least for a short distance, appeared to be similar if not exactly the same. I observed the phenomena described above day after day and no change in flyways ever was apparent. This behavioral characteristic seems to be peculiar to this tribe (Cressidini) of the Papilionidae.

Parides sesostris zestos Gray. Cayo Dist. 5♂♂; Stann Creek Dist. 2♂♂. This species along with *P. iphidamas* were the two most common forest swallowtails at Augustine; however, at Melinda it was the commoner of the two species.

Parides iphidamas Fabricius. Cayo Dist. 5♂♂, 1♀. These specimens constitute the first records of this species from the Cayo. It was a very common insect in the surrounding tropical forests.

Parides polyzelus polyzelus Felder. Stann Creek Dist. 3♂♂. This species was not seen at all at Augustine although Davis (1928) recorded it as being common in the Cayo District. However, at Melinda it was very common and was the second most abundant species of *Parides*.

Parides arcas mylotes Bates. Cayo Dist. 1♂; Stann Creek Dist. 1♂. Although this species was not common at either locality, the specimen from Stann Creek constitutes a new district record.

Papilio thoas autocles Rothschild & Jordan. Cayo Dist. 2♂♂, 1♀. This species was by far the most common representative of the entire family, being found in practically all sunny places.

FAMILY PIERIDAE

Dismorphia praxinoe Doubleday. Cayo Dist. 1♂, 1♀; Stann Creek Dist. 1♂. All of the listed specimens were taken along trails in the tall rain forest. This species has a very slow "fluttery" flight that is usually never over 4 feet above the ground. The color pattern of this species bears a remarkable resemblance to the color patterns exhibited by members of several other, unrelated genera, notably *Heliconius* (Nymphalidae) and *Mechanitis* (Ithomiidae). This resemblance or "mimicry" has been described by several authors, in particular Punnett (1915). However, nowhere are the behavioral similarities between these groups mentioned in any detail. The flight patterns of *Heliconius ismenius*,

Mechanitis egaensis and *Dismorphia praxinoe* (all of which were sympatric species) are so nearly identical that it is virtually impossible to distinguish between them when they are on the wing even when the individuals are very close. (*H. ismenius* is slightly larger in size than the other two species and therefore, with time and experience, this heliconid can be identified on the wing.) This is truly a remarkable phenomenon and appears to be an excellent example of Müllerian mimicry since all three groups are presumably distasteful to predators. When specimens of these three species were pinched, a noticeable foul or sourish odor was detected which appeared to be quite distinctive for each species.

Dismorphia fortunata Lucas. Cayo Dist. 1♂, 1♀. These specimens represent a new district record. All were taken along trails in the tall rain forest as in the above species. *D. fortunata* has an extremely weak flight, even weaker than in the preceding species, and rarely ever flys more than one foot above the ground. This flight pattern is almost exactly the same as that of the two species of ithomiids (*Oleria paula* and *Pteronymia cotytto*) which were taken in the same area of forest. Here again, when specimens are on the wing, it is almost impossible to distinguish the ithomiid from the pierid, morphologically or behaviorally. This species also gave off a rather sour odor when pinched.

Phoebis philea Linnaeus. Cayo Dist. 2♀♀; Stann Creek Dist. 2♂♂. This huge sulphur was common in both localities but was extremely hard to capture due to its rapid flight which was seldom closer than 20-30 feet of the ground.

Phoebis agarithe maxima Neumoegen. Cayo Dist. 1♀. This specimen was captured while it was feeding on a zinnia flower.

Phoebis argante argante Fabricius. Cayo Dist. 2♂♂, 2♀♀; Stann Creek Dist. 2♂♂. This species was by far more common than the preceding species at both localities.

Phoebis sennae marcellina Cramer. Cayo Dist. 1♀; Stann Creek Dist. 1♂. This was the most common member of the genus at both stations. It was frequently taken on *Hibiscus* flowers.

Phoebis statira Cramer. Cayo Dist. 4♂♂; Stann Creek Dist. 2♂♂. This species was fairly common at both localities. The males from Augustine were decidedly more yellow than the ones from Melinda. Individuals were commonly seen around mudholes in association with other pierids.

Eurema albula Cramer. Cayo Dist. 5♂♂, 1♀; Stann Creek Dist. 1♂. This species was fairly common along the trails in the secondary forests. It was never found in the deep shade of the forest or in the bright sunlight of the surrounding fields, it seems to have been more common in the partially shaded areas.

Eurema daira Latreille. Cayo Dist. 4♂♂, 2♀♀; Stann Creek Dist. 1♂, 1♀. This was a very numerous species at both locations, particularly in the pine lands. A great deal of variation was exhibited by these specimens (pure white females, solid yellow males and females and males with yellow forewings and white hindwings).

Eurema boisduvaliana Felder. Cayo Dist. 1♀. This individual represents a new district record. One other specimen was seen but not captured.

Eurema proterpia Fabricius. Cayo Dist. 3♂♂, 2♀♀. Although no specimens were taken at Melinda, this species was likewise common there.

Eurema lisa euterpe Ménétries. Cayo Dist. 2♀♀; Stann Creek Dist. 1♂, 3♀♀. This species was common in all open places, even in the pine lands.

Eurema nise perimede Prittwitz. Cayo Dist. 4♂♂; Stann Creek Dist. 1♂, 1♀. This species was often taken in the company of *E. lisa.* Both were equally common.

Appias drusilla Cramer. Cayo Dist. 1♂. This was not a common species. The single male was captured while it was feeding on a zinnia flower.

FAMILY DANAIDAE

Danaus eresimus Cramer. Cayo Dist. 1♂, 1♀. This was the only danaid seen around Augustine. It was fairly common in the sunny fields.

FAMILY ITHOMIIDAE

All the species listed below belonging to this family have very similar flight patterns. They all flew slowly and in the deep shade of the tall forests. Furthermore, when pinched, they all gave off a sourish odor that was decidedly different from the odors given off by *Dismorphia* and *Heliconius.*

Mechanitis egaensis doryssus Bates. Cayo Dist. 2♂♂, 2♀♀. This species generally flew between 5 and 6 feet of the ground and was very common.

Hypothyris lycaste dionaea Hewitson. Cayo Dist. 2♂♂, 3♀♀. This species is very similar to the above in its flight. It was likewise very common.

Napeogenes tolosa Hewitson. Cayo Dist. 3♀♀. This species is similar to the above also.

Oleria paula Weymer. Cayo Dist. 2♂♂. This species and *Pteronymia cottyto* differ from all of the preceding species in that they both fly very close to the ground, seldom more than 2 feet above the forest floor. *O. paula* was fairly common in the tall forest and its capture constitutes a new district listing.

Dircenna klugi Geyer. Cayo Dist. 1♂. This species was captured on the border of some tall forest flying approximately 5 feet above the ground. No other specimens were seen.

Dircenna euchytma Felder. Cayo Dist. 2♂♂. This species was definately more numerous than the preceding. The two males were captured flying about 6 feet above the ground along a wide trail.

Pteronymia cotytto Guérin. Cayo Dist. 1♂, 2♀♀. This was a common species in the virgin forests. As stated previously, its flight is very much like that of *O. paula* and *Dismorphia fortunata.*

FAMILY SATYRIDAE

Pierella luna heracles Boisduval. Cayo Dist. 3♂♂, 1♀. This species was fairly numerous, but local, along the trails in the secondary forest surrounding the village. It seems to confine itself to the paths, very seldom straying off into the underbrush. Individuals usually fly 2 to 3 inches above the ground and frequently alight on the leaf litter.

Taygetis mermeria Cramer. Cayo Dist. 1♂. This single individual was flying along a roadside.

Taygetis andromeda Cramer. Cayo Dist. 1♀; Stann Creek Dist. 1♂. The record from Stann Creek represents a new district listing. Both specimens were found in second growth forests.

**Euptychia gemma freemani* Stal. & Tur. Cayo Dist. 1♂, 1♀. These specimens constitute a new national record. Both individuals were taken in the pine lands surrounding the village. The species was fairly common in the grassy ground cover. No individuals were ever seen in the tropical forests.

Euptychia hesione Sulzer. Cayo Dist. 1♂, 4♀♀; Stann Creek Dist. 2♂♂. This species was very numerous along the borders of the secondary forests at both camps.

Euptychia metaleuca Boisduval. Cayo Dist. 2♂♂. These specimens were taken in the virgin forest west of the village. No individuals were ever seen in the secondary forests as was *E. hesione*.

**Euptychia themis* Butler. Cayo Dist. 4♂♂. This species was very common around Augustine although no specimens were recorded previously from the country. Individuals were frequently encountered along roadsides and in the secondary forests.

Euptychia hermes Fabricius. Cayo Dist. 4♂♂, 1♀; Stann Creek Dist. 2♀♀. This was by far the most common species of satyrid at both collecting sites. Literally hundreds of individuals were observed during the course of my stay.

**Euptychia glaucina* Bates. Cayo Dist. 1♂. This single male represents a new record for Br. Honduras. The insect was captured in a ravine in the Mt. Pine Ridge.

FAMILY BRASSOLIDAE

Caligo memnon Felder. Cayo Dist. 3♂♂. This species was fairly common in both the secondary and virgin forests around Augustine; one specimen was seen at Melinda. All individuals were taken while they were resting on tree trunks.

FAMILY NYMPHALIDAE

Morpho polyphemus luna Butler. Cayo Dist. 2♀♀. This magnificent butterfly was common in the tall rain forest west of the camp. Its domain is the canopy of the forest and thus it was exceedingly difficult to net (one of the specimens was actually shot down using 22 caliber dust shot).

Morpho peleides montezuma Guérin. Cayo Dist. 7♂♂, 2♀♀. This species was very common in both the secondary forests and virgin forests. It was also numerous around the woodlands at Melinda. *M. peleides* flys relatively close to the ground (3 to 4 feet) in contrast to the preceding species.

Actinote guatemalena Bates. Stann Creek Dist. 2♂♂, 1♀. All of the above specimens were taken while they were feeding on an unidentified white-flowering bush which was growing along the edge of a small patch of secondary forest. No specimens were seen anywhere else other than at this one locality.

Heliconius ismenius telchinia Doubleday. Cayo Dist. 3♂♂, Stann Creek Dist. 2♂♂, 2♀♀. This species was fairly common at both localities. It was found in both the secondary growth and virgin forests. When squeezed, these specimens extruded two bright yellow glands from the tip of their abdomens. Immediately following this, a very pungent, acrid odor was noticed. This odor diffused through the air for several yards and lingered for several minutes. These glands were noticed on all of the species listed in this tribe. As stated previously, the odor was very different from that produced when the two species of Dismorphiinae and the various species of Ithomiinae were squeezed.

Heliconius doris transiens Staudinger. Cayo Dist. 4♂♂. This species was encountered only in the advanced forest surrounding the village and its capture represents a new district record. Where ever small clearings existed in the forest and where the sunlight was able to penetrate the canopy and reach the ground, *H. doris* was always to be found. This species was never observed in close proximity to the ground but always from 7 to 15 feet in the air.

Heliconius petiveranus Doubleday. Cayo Dist. 6♂♂, 1♀; Stann Creek Dist. 1♂. This species, unlike the preceding, was encountered consistently in the secondary forests. Likewise, its flight is very different from that of *H. doris* for it was never seen above 4 feet of the ground.

Heliconius charitonius vasquezae Comstock & Brown. Cayo Dist. 2♂♂, 3♀♀. The Zebra was the most frequently encountered heliconid in both districts, it being most numerous around the tall, grassy or shrubby areas. It was never seen in the shade of the forest. Its flight was usually from 6 to 10 feet above the ground and was fairly rapid and erratic, very much in contrast to the preceding species.

Eueides aliphera gracilis Stichel. Cayo Dist. 1♂, 1♀; Stann Creek Dist. 1♂. This species was fairly common in the sunny fields at both collecting sites. In flight, it was usually within 2 to 5 feet of the ground.

Eueides cleobaea zorcaon Reakirt. Cayo Dist. 1♀. This individual was captured while it fed on a zinnia flower. This was the only specimen seen and it constitutes a new district record.

Dryas julia delila Fabricius. Cayo Dist. 2♀♀. This was a very common species along the roadside and in the grassy fields at both collecting stations.

Agraulis vanillae incarnata Riley. Cayo Dist. 1♂. Although Davis (1928) records this insect as being common everywhere in the country, I failed to find it so. This single male was captured while it was flying about a passion flower vine (*Passiflora* sp.). One other specimen was seen here at this time but was not captured.

Euptoieta hegesia Cramer. Stann Creek Dist. 1♀. At Stann Creek, this insect was fairly common in the coastal pine lands. However, due to its strong, erratic flight, only one individual was captured. Although no specimens were captured at Augustine, several were seen as they rested on the red mud roads in the pine ridge section.

Chlosyne theona theona Ménétries. Cayo Dist. 1♂, 4♀♀. This species was numerous in the grassy fields around the village.

Chlosyne lacinia lacinia Geyer. Cayo Dist. 1♂, 1♀. This was not a common species at either locality. All specimens that were taken, were netted while they fed on flowers growing along the roadsides.

Chlosyne erodyle Bates. Cayo Dist. 5♂♂, 1♀; Stann Creek Dist. 1♂. This species was fairly common around Augustine but a bit scarcer at Melinda. All individuals were netted either while they fed on flowers or while they rested on bare rocks or cement in the full sun. The latter is quite an interesting behavioral pattern because on many occasions I noticed individuals at rest on these two types of objects. At such times, they were not absolutely still but were engaged in spreading and closing their wings.

Phyciodes claudina guatemalena Bates. Cayo Dist. 2♂♂, 2♀♀. Although recorded only from the southern part of the colony (Davis, 1928), I found this species to be fairly common at Augustine in all sunny fields that were surrounded by secondary forests. Individuals

never were observed far from shrubbery.

Phyciodes myia Hewitson. Cayo Dist. 3♀♀. This species, like the preceding, was recorded only from Punta Gorda in the southern part of the country (Davis, 1928). However, it too, was fairly common around Augustine although not quite as common as *P. claudina.*

Precis genoveva Stoll. Stann Creek Dist. 1♂, 2♀♀. This species was fairly common in both the Mt. Pine Ridge and the coastal pine land area.

Metamorpha steneles biplagiata Fruhstorfer. Cayo Dist. 1♂, 3♀♀. All specimens were taken along the borders of secondary forests. The species appeared to be locally common.

Anartia jatrophae luteopicta Fruhstorfer. Cayo Dist. 3♀♀; Stann Creek Dist. 1♂, 1♀. This species was very abundant at both collecting sites, being found in all open, sunny places.

Anartia fatima fatima Fabricius. Cayo Dist. 1♂, 4♀♀; Stann Creek Dist. 1♂. This species and *Mestra amymone* were the two most frequently seen butterflies around Augustine, being slightly less abundant at Melinda.

Pyrrhogyra hypensor Godman & Salvin. Stann Creek Dist. 1♀. This specimen, which represents a new district listing, was taken along the Hummingbird Highway just east of Melinda. Two other individuals were seen here but escaped capture due to the thickness of the grass in which they were flying.

Pyrrhogyra otolais neis Felder. Cayo Dist. 3♀♀. This species was common in the secondary forests around the village. Individuals were frequently encountered along the sunny paths that led through the woods.

Pseudonica flavilla canthara Doubleday. Cayo Dist. 1♀. This species was fairly common in the cultivated corn fields scattered about the village. Its flight is usually from 2 to 3 feet above the ground.

Tenenis laothoe liberia Fabricius. Cayo Dist. 2♀♀. All specimens were taken on the borders of secondary forests. The species was not common.

Catonephele nyctimus Westwood. Cayo Dist. 1♂, 1♀; Stann Creek Dist. 1♀. These specimens were all taken along trails in second growth forests. The specimen from Stann Creek represents a new district listing. *C. nyctimus* appeared to be more numerous in shrubby areas where the undergrowth was quite tangled.

Mestra amymone Ménétries. Cayo Dist. 1♂, 4♀♀. This species was one of the most common butterflies around Augustine being found even in the pine stands. Its flight was usually never over 3 feet off the ground.

Hamadryas februa gudula Fruhstorfer. Cayo Dist. 1♂. This species was fairly numerous in the corn fields surrounding the village. In-

dividuals were frequently seen resting on tree stumps and on burned debris lying on the ground. When at rest, they keep their wings spread in a horizontal plane. In such a position, specimens are not easily distinguished from the lichen-covered tree trunks. The clicking sound made by members of this species, as well as of the following species, is audible for distances up to 30 yards.

Hamadryas feronia farinulenta Fruhstorfer. Cayo Dist. 2♂♂, 1♀; Stann Greek Dist. 1♀. This species was more numerous than the preceding one. Individuals were frequently seen in small patches of woods.

Biblis hyperia aganisa Boisduval. Cayo Dist. 4♂♂, 1♀. This species was reported by Davis (1928) to be uncommon throughout the country. However, at Augustine, *B. hyperia* proved to be very common. Indeed, it was quite numerous along the roadsides which were bordered by shrubby areas.

**Limenitis melanthe* Bates. Cayo Dist. 1♂, 1♀. These two specimens represent the first records of this species from the country. Both individuals were captured as they were flying around some shrubs which were growing on the top of a small knoll. Several other specimens were seen during the course of my stay at Augustine but due to their fast, erratic flight, they could not be netted. It appears that *L. melanthe* is quite local in its occurrence.

Limenitis cytherea marcia Fruhstorfer. Stann Creek Dist. 2♂♂. These two specimens constitute a new district record. Both were captured along the border of a small patch of tropical forest in the coastal pine land south of Melinda.

Limenitis iphicla Linnaeus. Cayo Dist. 2♀♀; Stann Creek Dist. 1♂. The habitat of this species is very similar to that of the preceding.

**Dynamine theseus* Felder. Cayo Dist. 3♀♀. These three specimens represent a new listing for the country. They were all taken in a cultivated corn field north of the village. The species was quite common at that locale, frequently alighting on the leaves of the corn plants. Individuals of *theseus* fly close to the ground.

Dynamine mylitta Cramer. Cayo Dist. 1♂, 2♀♀. These individuals were taken along a roadside near the village. They were flying approximately 2 feet above the ground.

**Dynamine glauce* Bates. Cayo Dist. 1♀; Stann Creek Dist. 1♂. These represent a new national record. This species was definitely less common than the preceding two. Its habits were similar to them, however, with the exception that *D. glauce* was seen near heavier forest cover more frequently than either *D. theseus* or *D. mylitta*.

**Dynamine dyonis* Geyer. Cayo Dist. 6♂♂, 4♀♀. These records constitute a new national listing, also. *D. dyonis* was the most common

representative of the genus around Augustine. All of the females listed above were found fluttering in open, grassy areas. The males were captured as they flew around the new foliage of a mango tree. This tree was approximately 15-20 feet in height and these butterflies could be seen every sunny morning flying about and frequently alighting on the new leaves. After alighting (or when resting), all individuals held their wings out in a horizontal position fully exposed to the direct rays of the morning sun. However, after 11:00 A.M. (approximately), not a single male was seen near this tree and females were not seen around the tree at any time.

Marpesia chiron Fabricius. Stann Creek Dist. 1♂. This insect was a fairly common one at both localities but due to its erratic flight, only a single specimen was taken.

Smyrna blomfildia datis Fruhstorfer. Cayo Dist. 1♂. This individual was taken as it fed on some sap which was exuding from the trunk of a mango tree. No other specimens were seen.

Gynaecia dirce Linnaeus. Stann Creek Dist. 1♀. This female was the only individual of this species observed during my entire stay in Br. Honduras. It was captured in a small track of secondary forest.

**Prepona amphimachus* Fabricius. Cayo Dist. 2♀♀. This is the first record of this species from Br. Honduras. Both females were taken as they flew along a path in a section of virgin forest. The flight of this specimen was extremely swift and erratic. Several other specimens of the genus *Prepona* were seen in this forest but none could be captured and their identity could not be ascertained.

Anaea electra Westwood. Cayo Dist. 1♀. This individual was captured along the edge of a small patch of woods.

Anaea morvus boisduvali W. P. Comstock. Cayo Dist. 1♀. This species is listed as *A. morta* by Davis (1928) who states that "a single specimen was taken in a forest road in the Western District". Therefore, it appears that the female listed above represents the second specimen from the country.

FAMILY LYCAENIDAE

Eumaeus minyas Hübner. Cayo Dist. 3♂♂, 2♀♀. This species was locally common around Augustine being found in isolated colonies in several areas of secondary forest.

**Thecla ragalis* Cramer. Cayo Dist. 1♀. This specimen, which represents a new national record, was taken along a wide path in some secondary forest. No other specimens were seen.

Thecla marsyas damo Druce. Cayo Dist. 4♀♀. This was a common species in the shrubby fields near Augustine. One specimen was seen at Melinda.

**Thecla mavors* Hübner. Cayo Dist. 2♂♂, 1♀. These individuals constitute a new national record. All were captured as they rested on the leaves of a mango tree (see *Dynamine dyonis*). This species was quite common on this tree during the morning hours.

Thecla linus togarna Hewitson. Cayo Dist. 3♂♂. These specimens represent a new district listing. All were taken along the borders of small woodlands.

**Thecla meton* Cramer. Stann Creek Dist. 1♂. This insect represents a new record for the country. The single specimen was collected on the edge of some secondary forest. No other specimens were seen.

**Thecla syncellus syncellus* Cramer. Stann Creek Dist. 1♀. This individual was found in a small patch of tropical woods in the coastal pine region south of Melinda. This species was unrecorded previously from the country.

**Thecla orcidia* Hewitson. Cayo Dist. 3♂♂. These three individuals are new records for Br. Honduras. All were taken as they flew around the top of the same mango tree as described under *D. dyonis*. Several other individuals were seen at this same spot.

**Thecla ahola* Hewitson. Cayo Dist. 2♀♀. This species represents a new national record. Both specimens were captured in a very shrubby field.

Thecla gabatha Hewitson. Cayo Dist. 1♀. This species, previously recorded by Seitz (1923) for the country, was taken as it rested on a *Bromelia* sp. flower in a dense, secondary forest.

**Thecla celmus* Cramer. Cayo Dist. 1♂. This individual which represents a new national record, was captured on the edge of primary forest west of the village.

**Thecla scopas* Godman & Salvin. Stann Creek Dist. 1♀. This specimen was taken along a trail in some secondary forest which was located in the coastal pine land south of Melinda. This is the first record of this species for the country.

**Thecla serapio* Godman & Salvin. Cayo Dist. 1♂. This specimen represents a new national record. It was captured on the margin of a small patch of second growth woods.

**Thecla basalides* Gayer. Cayo Dist. 1♂. This species was found in the same locale as the preceding one. It, likewise, constitutes a new record for Br. Honduras.

**Thecla mulucha* Hewitson. Cayo Dist. 2♂♂. This is the first listing of this species from the country. Both individuals were netted along a roadside.

**Thecla* sp. Cayo Dist. 1♂. Mr. Harry K. Clench informs me that this specimen (Field No. 629) represents an undescribed species. He

further states that he has a similar specimen also from Br. Honduras in his possession. The species will be described by him at a later date.

**Tmolus echion echiolus* Draudt. Cayo Dist. 1♀. This specimen represents a new national record. It was captured in a grassy area. No other individuals were observed.

**Calycopis isobeon* Butler & Druce. Cayo Dist. 2♂♂. These individuals constitute new records for Br. Honduras. They were also captured in a grassy field.

Calycopis sp. Cayo Dist. 2♀♀. Two females belonging to this genus still remain unidentified. (Field nos. 496, 631).

Everes comyntas Godart. Cayo Dist. 2♂♂. This species was very common in the grassy areas both in the tropical regions and in the pine regions.

FAMILY RIODINIDAE

**Perophthalma tullius lasius* Stichel. Cayo Dist. 1♂. This small individual, which represents a new listing for Br. Honduras, was taken in some tall rain forest. It was flying about five feet above the ground and along a fairly wide trail. No other specimens were seen.

Mesosemia tetrica Stichel. Cayo Dist. 2♂♂, 1♀. These specimens constitute a new district record. All were taken in the shade of some secondary forest. The species was local, colonies being isolated from each other by as much as a mile. Individuals, when at rest, hold their wings at a 45° angle to the body.

**Cremna umbra* Boisduval. Cayo Dist. 1♂. This individual represents a new national record. The specimen was captured along the margin of a small patch of secondary woods. It was resting on the undersurface of a leaf.

**Lyropteryx lyra cleadas* Druce. Cayo Dist. 1♀. This individual constitutes a new record for Br. Honduras. It was captured along a trail in some secondary forest.

Ancyluris inca inca Saunders. Cayo Dist. 1♀.This individual was captured as it was flying about 3 feet above the ground along a path in some primary forest.

Rhetus arcius thia Morrison. Cayo Dist. 1♂. Recorded under the name of *Diorhina butes* (Godman and Salvin, 1879-1901), as being taken at Corozal in the northeastern part of the country, this specimen represents a significant range extension for the species. This male was taken as it was flying around a mango tree. One other specimen was seen during my stay at Augustine.

Calephelis velutina Godman & Salvin. Stann Creek Dist. 2♂♂. This species was previously recorded only from the extreme southern part of the colony (Davis, 1928). However, at Melinda, this species was

not uncommon.

Calephelis argyrodines Bates. Cayo Dist. 3♂♂, 1♀; Stann Creek Dist. 2♂♂. This species was common in the open fields at both localities. At Augustine, the species extended into the pine forests. These are the first records of this species from Br. Honduras.

Emesis lucinda saturata Godman & Salvin. Stann Creek Dist. 1♀. This insect was captured along a trail leading through some secondary woods.

Emesis liodes Godman & Salvin. Stann Creek Dist. 1♀. This insect was taken in the same locality as the preceding species. It represents a new national record.

Peplia lamis molpe Hübner. Cayo Dist. 1♀. This insect was fairly common in the grassy fields which were immediately adjacent to second growth forest. *P. lamis* was recorded previously only from the Corozal (Godman & Salvin, 1879-1901).

Theope diores Godman & Salvin. Stann Creek Dist. 1♂. This male constitutes a new national record. It was captured in the shade of some secondary forest.

Acknowledgements

I am very much indebted to the following people and would like to express my appreciation to them: Dr. G. H. Lowery, Dr. S. M. Russell and Mr. and Mrs. P. J. Fogg (Louisiana State University) for their help with preliminary arrangements regarding my trip; the Forestry Commission of Belize and in particular, Mr. A. Frith and Mr. A. N. Wolffsohn for their assistance with my housing accomodations; Dr. M. S. Blum and Dr. L. D. Newsom (Louisiana State University) and Dr. E. N. Lambremont (U.S.D.A., L.S.U.) for their criticisms regarding this manuscript; Mr. F. M. Brown (Fountain Valley School, Colorado Springs, Colorado), Mr. H. K. Clench and Dr. R. M. Fox (Carnegie Museum, Pittsburgh, Pennsylvania), and Sr. E. C. Welling (Merida, Mexico) for their help regarding various and numerous taxonomic problems; "Domingo" and family for their helpfulness concerning my domestic duties and for providing me with valuable information regarding the countryside; and lastly, Mr. M. J. Fogarty (L.S.U.) who accompanied me on this trip and served as my field partner.

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MIGRATION OF *KRICOGONIA LYSIDE* IN MEXICO (PIERIDAE)

A huge migration of *Kricogonia lyside* Latr.was seen flying across the highway between Ciudad Mante and Ciudad Victoria in the state of Tamaulipas, Mexico, on October 23, 1963. Tremendous clouds of the butterflies were seen which obscured much of the surrounding landscape and even obliterated the highway at intervals. There were six principal waves of the butterflies that were spaced a few yards apart, with many intermingling between the clouds. They were flying rather close to the ground, not more than ten feet high. Their directional flight was from the east to the west in an almost due course towards the foothills of the Sierra Madre Oriente range. The samples observed were of *lyside* only, without an admixture of other species, were about equally males and females, and most examples were in fresh condition. The main flights were seen at eleven in the morning. The day was sunny with no wind. The flight was not more than about one fourth of a mile thick, and there were no specimens observed at Ciudad Victoria.

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A BILATERAL GYNANDROMORPH OF *AUTOMERIS IO* (SATURNIIDAE) TAKEN AT MERCURY VAPOR LIGHT IN CONNECTICUT

by Sidney A. Hessel

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There recently appeared in this *Journal* (vol.17: 43-44; 1963) a short paper in which was announced the capture of a bilateral gynandromorph of *Automeris io* Fabricius. The purpose of the present paper is to present a detailed description and discussion, with photographs, of the specimen there mentioned. Capture was on 13 June 1962 at my home in Washington, Connecticut, by a Robinson trap powered with a 125 watt mercury vapor lamp.

A series of 30 males and 15 females from southern New England and the New York City region were carefully examined to determine if any character of the subject specimen presented intermediacy or a significant difference or extreme for the respective sex. In all instances the gynander fell well within the range of variation presented by this series. Many details will, therefore, not be set forth, but the characters studied are summarized: forewing (size, color, AM and PM lines, discal and apical patches, color flush and scale character of inner margin area); hindwing (color, eyespot size, shape, and position); head (antennae, palpi).

Viewed dorsally, the division between the ♂ (left) and ♀ (right) sides is spectacularly distinct, the line running from between the antennae to the tip of the abdomen being clear and even. Its sharp definition is accentuated not only by the marked sexual color difference, but also by the character of the abdominal vestiture which is normally much longer and erect in the male of this species. The antennae and wings maintain their separate sexual integrity in all respects. The size of the wings on the male side appears average, that on the female side a bit smaller than average, though obviously larger than the left wings; the pattern differences between them manifest no feature abnormal or extreme for their respective sexes, and no intermediacy. Unfortunately, I have no other *io* gynandromorph available for comparison. The deep pilrose scaling of the basal area of the female forewing is in sharp contrast to the flatter scaling of the same area of the male forewing, while the typically heavier scaling of the male hindwing in the region of the inner margin prevails there; in this latter area there is no sexual color distinction between the sexes of the species.

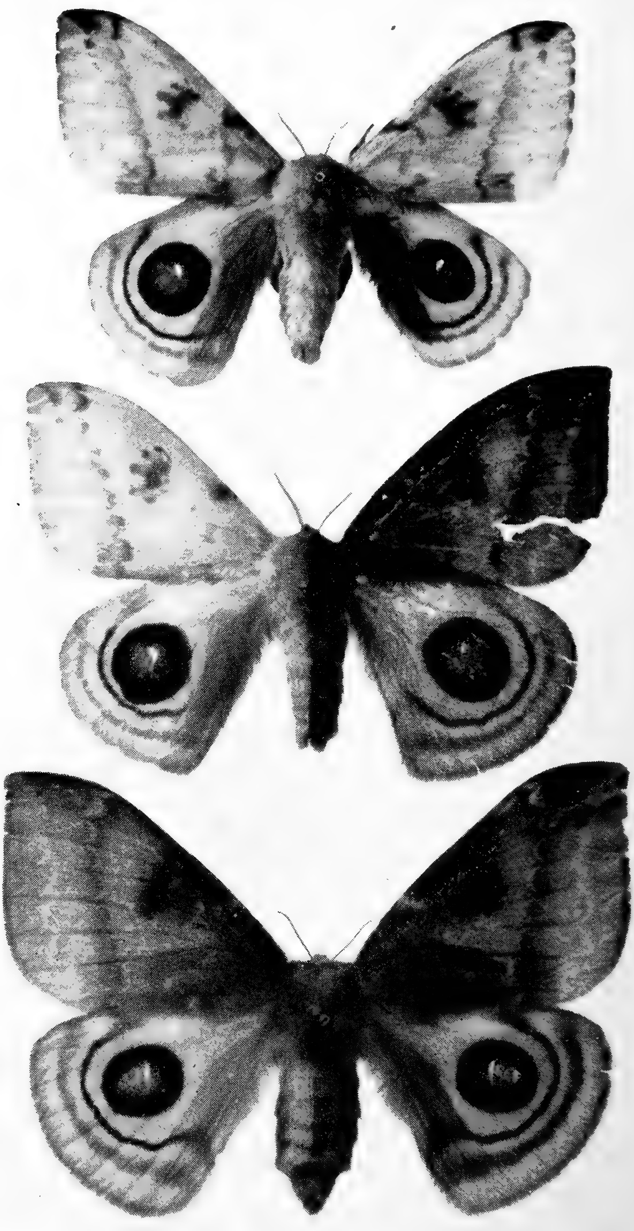

Figure 1: *Automeris io*. Top – male (right hindwing stunted), North Haven, New Haven Co., Conn., 28 May 1957, *leg*. C. L. Remington. Middle – gynandromorph (left side ♂, right side ♀), Washington, Litchfield Co., Conn., 13 June 1962, *leg*. S. A. Hessel. Bottom – female, Washington, Litchfield Co., 25 June 1960, *leg*. S. A. Hessel.

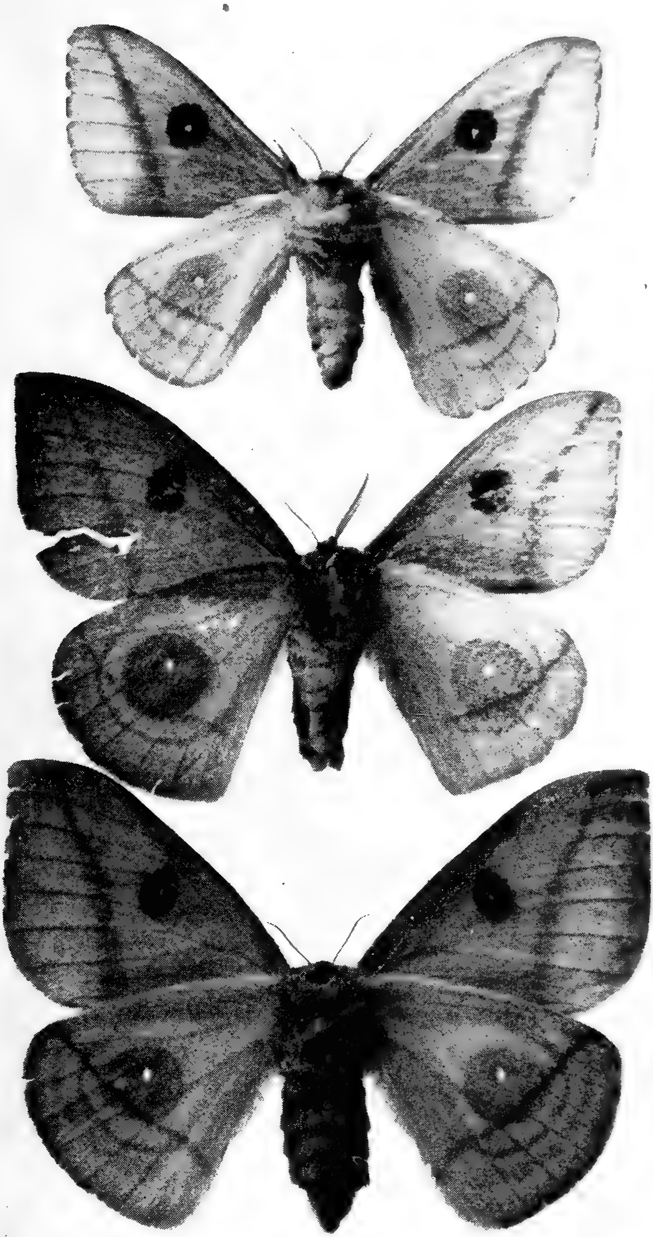

Figure 2. Undersides of the same specimens shown in Figure 1.

Viewed ventrally also, the wings appear sexually bilateral, as does the head. It may be mentioned that the heavy antennal lashes are present at the base of the left antenna as in a normal male (sparse in the female). The female eye is slightly smaller and rounder and the palpus dwarfed. The scales between the eyes continue the color division line, but the male side, including the maxillary palpi, is darker than the bright yellow parts, as is the case in the normal male. Progressing through the thorax, all is yet as would be expected, including the legs. At this point we lose the line of demarcation.

The abdomen itself is not truly perfectly bilateral, because the female "half" is broader and less tapering, a feature quite to be expected. It is also, concerning the abdomen that the only apparent respective sexual bilateral purity is at all violated. There is no encroachment of femaleness on the male side. Conversely, however, two small areas of yellow scales, obscure in the photo, appear on segments 4 and 5, so distad of the median line as to seem more lateral than dorsal; they are, in fact, tongues of a relatively extensive lateral male area. Besides these, there is a striking anomaly consisting of a yellow caudal tuft similar to that on the opposite (male) side. The vestiture of the abdomen clearly delineates the venter; this is altogether the yellow of the male, including the aforementioned caudal tufts of the valvae.

Turning now to the lateral aspect, on the male side we find no irregularities, but observation of the other (female) side discloses a curious mosaic. Abdominal segments 1-5 are predominately of the male color, those distad of the female color, except the already mentioned caudal tuft, an exclusively male character. There are several small but distinct patches of scales of female color on segments 1-5. The external genitalia appear to be male. In the absence of denuding, it is possible that some abnormalities could be concealed.

The light trap in which the specimen was captured has been operated during the last three "*io* seasons". No normal females have been taken. In about ten years of "black-light" collecting before a sheet at this location only about three or four females have been observed, although very many males have appeared. Thus, the method of capture tends to indicate physiological maleness of the specimen.

It is, of course, a matter of intense interest to consider the genetics involved. Bilateral gynandromorphs may arise either by virtue of a binucleate ovum or by the loss somehow of an X chromosome in the very first cell division of a fertilized male egg. In either case, it seems certain that in this instance further abnormal cell divisions of the latter nature occurred at least once and probably more often in later development. I leave to someone more versed in this subject to interpret in

genetic terms the combination bilateral and mosaic pattern. Perhaps information on the origin and order of development of the various parts of the insect are graphically demonstrated.

I am more than casually impressed that the year 1962 also yielded bilateral gynandromorphs of *Eacles imperialis* Drury and *Callosamia promethea* Drury. The former was captured in the presence of Joseph Muller at Pottersville, New Jersey, on 20 July 1962 and is in his collection. The latter was found by a young lad, Richard Orelup, at Crown Point, Indiana, among several moths emerging from cocoons.

Since this is such a rarely encountered phenomenon in the Lepidoptera, especially remarkable for as extensively collected a group as the Saturniidae, it makes one wonder if the finding of three gynanders in one year is within the limits of expectancy for the conditions under which we have heretofore been collecting, or whether some fundamental environmental change is now actually taking place. It is hoped that anyone who has had experience with lepidopterous gynandromorphs of this nature, particularly with finds of recent date, will communicate the information to me, or report it in this *Journal.*

THE FIRST RECORD OF *EUREMA CHAMBERLAINI* (PIERIDAE) IN THE UNITED STATES

During the latter part of March and the first of April 1963, Dr. Howard Weems and I were on a collecting trip through central and southern Florida. On 30 March, we were collecting at Ross and Castillo Hammock, Dade Co., Florida, where I was so fortunate as to take a specimen of *Eurema chamberlaini* Butler. At the time, I was collecting *Eurema lisa* for a type locality series and did not realize I taken a rare specimen until I mounted the material later in the fall.

I would like to thank Frank W. Mead for his assistance and Dr. A. B. Klots who made the determination and stated that it is the first known United States record for this species.

The specimen is deposited in the Florida State Collection of Arthropods, located in the Division of Plant Industry, Florida Department of Agriculture, Gainesville, Florida.

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ADDITIONAL NOTES ON THE LIFE HISTORY OF *NEOTERPES EDWARDSATA* (GEOMETRIDAE)

by JOHN ADAMS COMSTOCK

Del Mar, California

During the summer evenings of 1962 the geometrid moth, *Neoterpes edwardsata* Packard, was unusually abundant at light in Del Mar, California. This made possible the completion of the life history record previously published in 1955. At that time I neglected to illustrate the egg and larva, although attention was called to a previous paper published in 1942, on a closely related form, *Neoterpes ephelidaria* (Hulst), which paralleled in many particulars the metamorphosis of *N. edwardsata.* Eggs of the latter species were obtained on April 10, 1962. These hatched April 17 and 18.

EGG (fig. A.): 0.75 mm. to 1. mm. by 0.4 mm. to 0.7 mm. Oval, with a slightly flattened base. When first laid they were greenish-yellow, which gradually changed to yellow. Shortly before hatching they became spotted and streaked with reddish-brown. The illustration on the plate (fig. A) shows the yellow phase before the spotting had occurred. The surface of the egg is covered by vertical (longitudinal) ridges, 18 to 20 in number, which arise at the flattened base and end at the rounded top where they break up into irregular pits. The ridges are topped with a line of pearly white nodules. Between these ridges there are well defined horizontal striations. The eggs are laid singly on their sides.

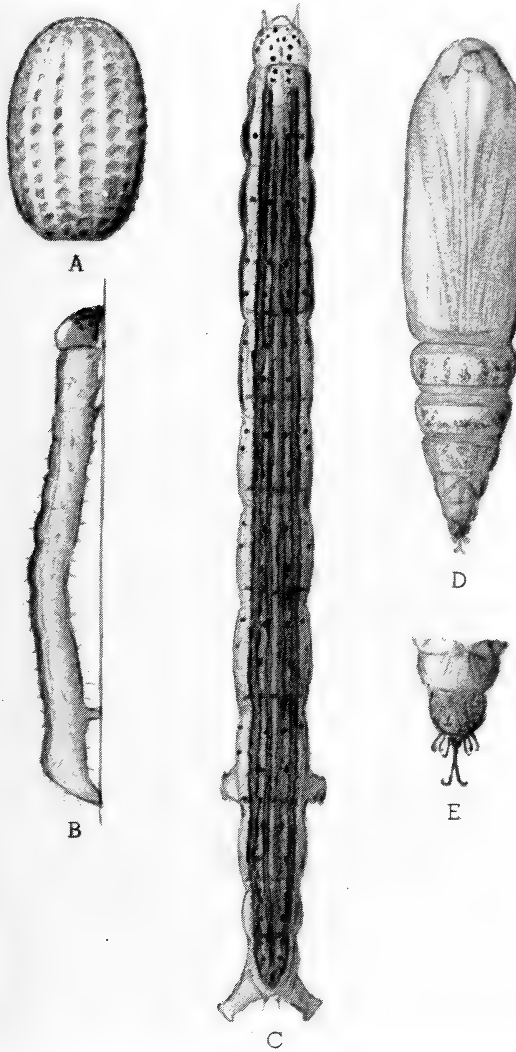
FIRST INSTAR LARVA (fig. B): Length 2.8 mm. Head width 0.25 mm. Body, cylindrical and comparatively narrow. The head is well rounded, and wider than the first segment. It is translucent deep yellow. The ocelli are conspicuously black, and the mandibles are edged with yellow-brown. The body ground color is light yellow. There is a middorsal longitudinal wide gray band, and paralleling it laterally a faint narrow dark stripe. The single pair of prolegs and the anal prolegs are concolorous with the body, as are also the true legs. The body form is accurately pictured in fig. B.

SECOND INSTAR LARVA: Length 5.5 mm. Head width approximately 0.6 mm. There are green and yellow examples. In the yellow form, the gray middorsal band persists but is less clearly defined. It is bordered by a narrow whitish band. The remainder of the body is yellow.

LARVA OF 10 MM. LENGTH: Considerable color variation becomes apparent in this intermediate stage. There are green, yellow and tan forms. In all of these the wide middorsal band persists with varying

degrees of intensity and modification.

LARVA OF 15 MM. LENGTH: Head width 1.1 mm. In this phase there is great variation in the dorsal bands. Some foreshadow the characters that are present in the mature larva, by separating into a central paired element and two wider bands bordering it laterally. In



Early stages of *Neoterpes edwardsata.*

Fig.A. Egg, lateral aspect, enlarged × 40. Fig.B. First instar larva, lateral aspect, enlarged × 26. Fig.C. Mature larva, dorsal aspect, enlarged × 4½. Fig.D. Pupa, ventral aspect, enlarged × 5. Fig.E. Caudal segments and cremaster of pupa, ventral aspect, enlarged × 25.

Reproduced from water color drawing by the author.

this bordering band two black dots appear on each segment, close to the segmental junctures. Lateral to these dots, and running the length of the body is a narrow yellow line.

MATURE LARVA (fig. C): Length 28 to 30 mm. Head width 1.8 mm. In all examples under observation the ground color was tan, or in a few specimens, soiled ochre, overlaid with numerous longitudinal darker stripes or dashes. No green forms were noted, but might possibly have been found in the wild. The middorsal longitudinal bands are eight in number, arranged in pairs of narrow dark lines, each enclosing a wider stripe of yellow or ochre. Laterally there is a longitudinal yellow stripe. The two black dots previously noted on each segment have increased to four, and in addition two dots appear on each side in the stigmatal area. The placement of these is shown in the illustration of the mature larva, fig. C. The legs and prolegs are concolorous with the body.

PUPA (fig. D.): Length 13 to 16 mm. In our previous papers of 1942 and 1955, illustrations of the pupa, in lateral and dorsal aspects, were shown. The structural details observable on the ventral surface were not recorded. The illustrations on the plate remedy this deficiency. It will be noted that the antennae and maxillae reach to the wing margin. The cremaster probably furnishes the best diagnostic features. This is shown on fig. E. The long central pair of spines arising from the caudal tip cross over each other. Their tips are recurved laterally. The three short recurved spines on each side, arising near the bases of the larger spines, seem to be a constant feature. These hooks make such a firm anchorage in the silk of the fragile cocoon that they are frequently broken or twisted on removal. Other details of the chrysalis were given in our previously published records.

The host plants of *N. edwardsata* are Bush Poppy (*Dendromecon rigida* Benth.) and Matilijah Poppy (*Romneya coulteri* Harv.). The closely related *Neoterpes ephelidaria* (which is probably a desert form of *edwardsata*) feeds on Chicolete (*Argemone platyceras* v. *hispida* Prain.). I have searched assiduously on California Poppy (*Eschscholtzia californica* Cham.) for possible infestation, without results. Other species of the Papaveraceae may possibly prove to be host plants.

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THE MATING TIME OF LEPIDOPTERA

by GEORG PRONIN

From an old balcony of our house in Osanovo, Russia, one could see a large meadow which was densely covered with grass, clover, daisies, and sorrel. Among this vegetation were bunches of rosy wild carnations and blue-bell flowers. Farther away the meadow changed into an elder grove, with bunches of wild hops, raspberries, and flowering cherries (*Prunus padus*). The old basswood garden was joined to the young birch groves at the other side of the old house. Close to this side of the wooden house was a young grove of aspen trees. The dense branches of lilac and acacia were growing directly against the windows of the house.

On the balcony a young boy sat motionless, looking very attentively at an old wire cylinder in which a big female moth was fastened. This female belonged to the northern race, *Gastropacha quercifolia alnifolia*, which has a dark violet shade over its brown ground color and is native in Moorom Woods of the government of Vladimir in Russia. Extending her heavy thick abdomen, the moth patiently waited for the males which were certainly flying around the house.

The evening was going its way. The redness in the sky changed slowly into the bright summer night's twilight, as is common in the north. The night was silent; only the grating voice of the Corn Crake was coming from the large spaces of wet meadows, and the corn fields sent the biting cry of the quail. Suddenly a little shadow of a male moth was seen coming from the roof of the house. The boy moved too quickly, and the night visitor flew high up and disappeared. After that, although the young enthusiast sat near his moth in the wire cylinder evening after evening, nothing happened. Only one male was seen at the cage. These moths have no mouthparts and therefore can not take food. The only task which the adult males have is to find and fertilize females. Perhaps this female was not attractive to the males, but the boy could not believe that.

Another female of this species was bred from a large, gray caterpillar which had been found sitting on a low willow branch. When disturbed, it showed large dark blue hairy brushes near its head. The caterpillar made a hairy cocoon, changed into a pupa, and after nearly three weeks hatched into a robust *G. quercifolia* female. Evening after evening, beginning as late as nine o'clock, the young entomologist sat hour after hour waiting in vain for attracted males. Everything seemed all right, but something was wrong. As four days passed, the female began to lay her eggs and on the fifth day she died.

Nearly twelve years later, in another part of the country, more to the

west in Luck, Wolhyn [now Lutsk, Volyn, Russia] the young entomologist was again sitting at a wire cylinder which enclosed another female of the *G. quercifolia.* A big fruit garden surrounded the observation spot. The wire cage was put on the top of an old wooden box which once served as a beehive. The observation had begun at eight o'clock and at 8:45 three males were attracted. Evening after evening the entomologist collected the males which were attracted from 8:45 for a period of only seven or eight minutes. After this very short time no more males were seen. The question was answered. The young boy had begun his observations in Osanovo too late in the evening, when the courtship flight period of the males had already ended.

The males of the moth *Philudoria potatoria* are very similar to those of *G. quercifolia.* The young collector was very familiar with them in his old basswood garden, and had often placed a female of *P. potatoria* on a branch in the garden but never found a male there before nearly ten o'clock. The boy had thought that the mating hours of *G. quercifolia* would also be late, but the analogy is not the proof. The mating hour of *G. quercifolia* is 8:45, and of *P. potatoria* 10:35.

But we must not be too severe with the boy for his error. The old genial entomologist, Henri Fabre, also made such a mistake. He waited in vain for the coming of the male *Lasiocampa trifolii* during the bright sunshine, guided only by the resemblance of the caterpillars of *trifolii* to those of *L. quercus,* which visits its female between two and four PM daily. The sexual flight of *L. trifolii* is at nine in the evening.

We must distinguish the flying hours from the mating time, because they are not the same. For example, many hawk moths, which have tongues for sucking nectar, fly at twilight to feed but have their mating hours later, after feeding. The common European sphingid, *Laothoe populi,* begins flying after 9 PM and the mating hours are after midnight. Perhaps another reason for this is that the young males thus have time to fly very far from the place of their birth and this makes mating with their sisters improbable.

Here is a short table of mating hours observed for different moths:

THE MATING TIME OF MOTHS

Species	Time	Month	Locality
Hyalophora euryalus Bdv.	10:30 PM	VI	Shasta Co., Calif., US
Saturnia pyri Schiff.	10:30 PM	V	Bosporus, Turkey
Saturnia pavonia L.	2-4 PM	V	München, Germany
Aglia tau L.	11-12 AM	V	Bayerbrun, Germany
Endromis versicolora L.	11-12 AM	IV	Vladimir, Russia
Macrothylacia rubi L.	4-6 PM	VI	Vladimir, Russia

Lasiocampa quercus L.	2-4 PM	VII	Luck, Wolyn, Russia
Lasiocampa trifolii Schiff.	9 PM	VIII	München, Germany
Lasiocampa grandis Rougeuh	8:45 PM	VIII	Bosporus, Turkey
Lemonia dumi L.	11-12 AM		Luck, Wolyn, Russia
Lymantria dispar L.	11-12 AM	VIII	Luck, Wolyn, Russia
Philudoria potatoria L.	10:35 PM	VII	Luck, Wolyn, Russia
Gastropacha quercifolia alnifolia O.	8:45 PM		Luck, Wolyn, Russia
Epicnaptera americana Harris	9:30 PM	VII	Marys Peak, Ore., USA
Orgyia antiqua L.	10-12 AM	VIII	Vladimir, Russia
Orgyia gonostigma F.	11-12 AM	VII	Luck, Wolyn, Russia
Laothoe populi L.	12:33 AM	VII	Luck, Wolyn, Russia
Smerinthus ocellatus L.	11-12 AM	VII	Luck, Wolyn, Russia
Mimas tiliae L.	10:15 PM	VI	Vladimir, Russia
	9:15 PM	VI	Kharkov, Russia
	7:15 PM	V	Bosporus, Turkey
Deilephila elpenor L.	9:45 PM	VI	Luck, Wolyn, Russia
Sphinx liqustri L.	11:30 PM	VI	München, Germany
Arctia caja L.	11 PM	VII	Luck, Wolyn, Russia
Eriogaster rimicola Hbn.	10 PM	VIII	Luck, Wolyn, Russia
Catocala elocata Esp.	8:15 PM	IV	Luck, Wolyn, Russia
Psyche unicolor Hufn.	11-12 AM	VII	Praha, Czechoslovakia
Fumea casta Pall.	6 PM; 4 AM	VII	Luck,Wolyn, Russia
Aegeria apiformis Cl.	11-12 AM	VI	Vladimir, Russia

Such a table must always have the locality, date, and the time of day. The locality gives us the possibility of determining the meridian correlation. An example of the importance of these data is the difference in mating times of *Mimas tiliae,* which begins to fly to his female in North Vladimir at 10:15; in Kharkov at 9:15, and in Bosporus, Turkey, at 7:15 PM. This phenomenon may be connected with the beginning of dew condensation.

An unusual mating time was observed in a pair of *Smerinthus kindermanni*. An old male was stored in a semi-dark cellar for about 6 days until a female was hatched. When he was put into the box with her, they began to mate at once, at 2 PM in daylight. It may be significant that the pupae had been brought from southern Iran, and the mating took place in Lodz in central Europe.

The mating time can be short, as observed in *Lasiocampa grandis,* whose caterpillar is similar to that of *L. quercus*. This species lives at Bosporus near Istanbul, Turkey, and I have reared it. One evening one of the big brown males came in through an open window and flew around the electric lamp. In my rearing box were two females. When

I took the box out into the garden, it was at once surrounded with a small swarm of males. This was at 8:45 PM and lasted only 4 or 5 minutes; then the entire lot of males flew away.

The mating time of *Hyalophora euryalus,* which I observed in Shasta County, California, is not short. The pupa of a female of this species had overwintered in her cocoon in an open wire cage at Hat Creek. The conditions were normal, and she hatched on June 5. I put her into a box with walls of tulle netting and took a seat at the beginning of twilight on the balcony of the Hat Creek Entomological Station. At almost 10 PM I could see one male after another flying continuously around the box. One male came very near to the box and after inquiry with his antennae he also flew away. Did the males know that the female was surrounded on every side by tissue? I could not tell. But to permit the female to mate without giving her the chance to escape I very carefully cut her wings so she could not fly, then placed her in a tall wide-mouthed jar, left it on the balcony, and went to sleep. The next morning I found the female mating with a very beautiful male which had come from the woods. On the previous evening the attractiveness of the female had been feeble in the first part of the night. This could be due to either of two reasons: the mating hours were nearer to midnight, or the female was not absolutely ripe.

Moths can mate only when the female wants to. I once tested the mating hours in a hybridization attempt. I placed many ripe females of *Philudoria potatoria* (formerly placed in *Gastropacha*), very near to a female *Gastropacha quercifolia.* The males of *potatoria,* attracted by their females,were coming directly through the open windows from the woods, but the female *G. quercifolia* could not be aroused then at the hour of 10:45 P.M.; her mating hours are from 8:45 P.M. to sunset, as noted above.

Often the ripening process is finished only on the second day of the female life. In such examples as *Lasiocampa quercus* and *Saturnia pyri* mating can occur only when the female is ready to attract males and pushes out her odoriferous organs. Also, the female normally attracts males only when she is unmated. One time I obtained a mating pair of *Laothoe populi,* but I could see that the male was too old and was worthless for fertilization. That night the female was still attractive to other males. In another experiment with this species, one male was given two females, one after the other. The copulation of *L. populi* lasts twenty hours. After two matings, this male was not accepted by a third female. In the mating process of *L. populi,* it was often observed that old females (of course not too old) have always attracted very big and robust males.

Lemonia dumi, a daylight flier, has as a rule the most frequent matings, because of its short adult life. It flies in Luck, Wolyn, Russia, after 8 October, when the nights are too cold for insect flight. The male hatches from the pupa in the early morning, flies during the day and evening, then hides in the grass and dies. Therefore, a young male which has been out of the pupa only half an hour is not able to fertilize an entire hatch of eggs at one mating. The supply must be increased in some way, and this is accomplished by more frequent mating during that one day.

This species of *Lemonia* is very closely adapted to its normal surroundings. I once transported a female, which I had reared from a pupa, to an entomological tower standing in an area covered with young trees. I placed her on the floor, two meters above the ground. Very soon I saw several males flying wildly around beside the bottom of the tower. The males have perfectly feathered antennae which help find the females, yet they did not make contact with her this time. But suddenly I understood the trouble. In nature it is impossible for the female to reach a point two meters above the ground because of her feeble legs. As soon at I put the box on the soil surface, it was surrounded by males.

There are very interesting kinds of Psychidae in which the females are wingless and must be found by their males. The females never leave their place of birth, a little bag made from short pieces of bark or narrow straws. One such psychid is *Fumea casta*, which is one of the smallest members of this family. The male has a wing spread of only 3 mm. Therefore the little insect is too feeble to fly to his female when the air, warmed by the sun, begins to rise from the soil surface, and must choose a time when the air is nearly motionless. This is only at 6 PM and at 4 AM. In order to determine the mating time of this species I kept a leaf, bearing the cocoon sack of a female, pinned onto the window frame at the entomological station in Kiwerce Wood near Luck, Wolyn, so that I would have it before my eyes at all times. The evening mating times were very easily observed. However it was more difficult in the morning. Occasionally I was awakened in the early morning just before sunrise and could see at that time the mating flight.

The intensity of the light seems to have no influence on the mating time. In Arkhangelsk, far northern Russia, near the White Sea, I saw the mating of *Melalopha curtula* L. The night in May is absolutely bright, and it was very surprising to see in clear daylight what in middle Europe was always covered with mysterious darkness.

Most species of butterflies do not have such definite differences in mating hours. The time in my observations is usually between one and three PM.

THE MATING TIME OF BUTTERFLIES

Species	Time	Month	Locality
Papilio multicaudatus Kirby	2-3 PM	VII	Shasta Co., Calif., USA
Papilio machaon L.	1-2 PM	VII	Polesie, Wolyn, Russia
Adelpha bredowii Geyer	2-3 PM	VIII	Shasta Co., Calif, USA
Nymphalis antiopa L.	2-3 PM	IV	Luck, Wolyn, Russia
Nymphalis polychloros L.	2-3 PM	IV	Luck, Wolyn, Russia
Nymphalis io L.	2-3 PM	IV	Kharkov, Russia
Polygonia c-album L.	2-3 PM	IV	Luck, Wolyn, Russia
Nymphalis urticae L.	2-3 PM	IV	Luck, Wolyn, Russia
Vanessa atalanta L.	4:15 PM	V	Luck, Wolyn, Russia
Vanessa cardui L.	6 PM	VII	Luck and Krym, Russia

Thus, each species of butterfly or moth has its own definite mating time. By making these comparisons, we can use the mating time as a subsidiary factor in recognizing different local forms and subspecies.

While most moths mate soon after hatching from the pupa, *Nymphalis* butterflies mate after their winter hibernation. *N. antiopa* in central Europe hatches from the pupa in early July and does not mate until April of the following year, immediately after the first feeding. I once observed this process in Tooshiuer Wood, near Lodz, Russia. I was walking along a forest path on 11 April at about 2 PM and came to an old tree of *Carpinus betulae* with sap flowing from a small bark wound. On the next tree, sitting on the bark, was a mating pair of *N. antiopa.* I put the pair in a box very carefully and went further. When I came back to the place an hour later, great was my astonishment at seeing a second pair of this species on another tree trunk. In my entire life I had never found insects of this species mating in nature, and now this happened twice in only one hour.

Some kinds of butterfly males are pugnacious during spring mating time. After he has chosen a little dirt hill on the edge of a forest path, *Nymphalis xanthomelas* Esp. is aggressive against a newcomer of any kind. When a foreign butterfly approaches the observation spot, the original occupant takes off and pursues savagely. Therefore the males of this species always have entirely shredded wings by the end of their mating season. In Golden Gate Park (San Francisco, California) males of the very common *Vanessa carye* have also *l'esprit combatif* and fly after each other energetically.

Butterflies often fly while actually mating. In this activity one mate is carried by the other. Here is a short table of my observations with reference to the sex which is the transporter.

Observations of Butterflies Flying while Mating

Species	Transporter	Place	Month
Aporia crataegi L.	female	Europe	VI
Pieris rapae L.	male	Europe	VI
Pieris napi L.	male	Europe	VI
Colias hyale L.	male	Europe	VII
Papilio machaon L.	female	Polesie, Russia	VII
Danaus plexippus L.	female	California, USA	XII
Adelpha bredowii Geyer	female	California, USA	VIII
Argynnis paphia L.	female	Europe	VII
Melanargia galathea L.	female	Europe	VIII
Erebia medusa Schiff.	female	Europe	VII
Pararge aegeria L.	female	Europe	VII
Aphantopus hyperantus L.	female	Europe	VII
Maniola jurtina L.	female	Europe	VII
Plebeius argus L.	male	Europe	VII
Polyommatus icarus Rott.	male	Europe	VII
Maculinea arion L.	female	Europe	VIII

The unusual mating flight of *Hemaris tityus* L. (near the American *diffinis* Bdv.), the Clearwing Sphinx, is made during the brightest daylight hours. The male and female fly while *in copula,* facing opposite directions. Therefore such a pair fly very, very slowly, because the speed of flight is only the difference between the speed of the female, which is the more powerful and robust, and that of the male.

I give my cordial thanks to Mr. Robert Judd, philologist, Mr. Hugh B. Leech, Associate Curator of Insects at the California Academy of Sciences, and Mrs. Jeanne E. Remington, who helped to prepare this article for publication.

[Mr. Pronin died of cancer on 28 October 1962, and the above article was assembled from a linguistically complicated draft he had submitted. C. L. R.]

A RECORD OF *GLAUCOPSYCHE LYGDAMUS* FROM MISSOURI

According to Mr. P. S. Remington, no specimen of the silvery blue, *Glaucopsyche lygdamus* Doubleday, has ever been captured in Missouri. One may imagine my astonishment, then, when on 12 April 1963, while collecting in Meramec State Park near Sullivan, Missouri I found one of these butterflies flying by the roadside. I had been watching it for several minutes, but since I was paying more attention to a puddle group of more than fifty *Erynnis* and *Celastrina* individuals, I let it go, taking it for just another *C. argiolus*. However, once I started stalking

it, its novelty was soon apparent, for alternating with brilliant blue upperside was sooty gray underside. It was only moderately active, staying by the roadside following the habits of the other puddle visitors. Its condition after capture was so nearly perfect that it must have emerged from the chrysalis just that morning. This rules out the possibility of it being a windblown stray, although it has been suggested that since the park is a camping spot and tourist attraction, it may have been casually introduced by travellers. Although this explanation at first seems rather far-fetched, the occurence of *lygdamus* there is in itself far-fetched, and thus, it is the only reasonable explanation besides the chance that it simply may have been overlooked previously. Knowing the number of collectors in my vicinity that are in the field at this time of year, the latter case is far from impossible, though.

The most distinctive character of the specimen is the rather uniform slate-gray underside darkened slightly at the base of the wings. The postmedian band of spots is jet black surrounded by white rings. The spots on the forewing are slightly larger than those on the hindwing. Above, the specimen displays the characteristic bright silver blue of the males with a narrow black marginal band and white fringes. Wingspan is exactly one inch.

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THE FOOD PLANTS OF *SYSSPHINX HEILIGBRODTI* (SATURNIIDAE) IN TEXAS

The early stages of *Syssphinx* (*Bouvierina*) *heiligbrodti hubbardi* (Dyar) have been described in a beautifully illustrated paper (*Bull. so. Calif. acad. sci* 46: 72-77; 1947), by Dr. John A. Comstock who reared it, *ab ovo*, on Mesquite. I reared the type race, *S. heiligbrodti heiligbrodti* (Harvey), *ab ovo*, in 1962 and found that the larvae accept equally well the following three plants: *Prosopis glandulosa* Torr. (Mesquite), *Acacia farnesiana* (L.) Willd. (Huisache), and *Acacia rigidula* Benth. (Black Bush Acacia).

In Texas *S. heiligbrodti* extends at least over the area south of a line going from Port Lavaca to Bastrop and from there to Del Rio. It is quite common in the southernmost part of its range, from May until October.

Greasewood (*Larrea divaricata* Cav.) (Creosote Bush) has been reported several times as being the food plant. Considering that *S. heiligbrodti* is rare or absent in western Texas where Greasewood is extremely abundant, this point should be checked.

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THE DATES OF PUBLICATION OF *LEPIDOPTERA, RHOPALOCERES-HETEROCERES* BY HERMAN STRECKER[1]

by F. Martin Brown

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Ever since the controversy (Aaron, 1884), in 1878 over the publication data for Number 14 of Strecker's *Lepidoptera, Rhopaloceres – Heteroceres,* there has been considerable question about the exact dates of issue of the various parts of that work. Since both Strecker and Edwards described as novelties butterflies from the same field-lots and in the same year it is important to establish the precise dates upon which these names became valid. Manuscripts treating the *Proceedings of the Entomological Society of Philadelphia* and the first ten volumes of the *Transactions of the American Entomological Society* in which Edwards published new names have been completed and are being published in the *Transactions of the American Entomological Society.* These will fix the dates for the names published by Edwards. The dates for the names published by Strecker are fixed in this paper.

Through the courtesy of Dr. Rupert Wenzel and the administration of the Chicago Museum of Natural History, I have had permission to study a mass of letters written to Strecker. Among these I have found letters from Herman H. Behr, William H. Edwards, Samuel H. Scudder and Richard H. Stretch containing acknowledgements of receipt of various parts of Strecker's *Lepidoptera.* Edwards and Scudder were regular pre-publication subscribers to the volume. In addition I have found one of Strecker's ledgers that records dates upon which he mailed copies of numbers 14 and 15.

In the following table I have stated Strecker's printed date for each number of his *Lepidoptera,* the earliest date I have found acknowledging receipt of it or the earliest date in the ledger for mailing, and a fair estimate of the date of issue for each number. The latter assumes a generous time in transit from Reading, Pennsylvania to the recipient, based upon the date of cancellation of letters and backstamps with the date the letter was received at Reading. The transit time to Stretch in California is estimated as ten days, to both Edwards and Scudder in Coalburgh, West Virginia and Boston, Massachusetts, respectively, is estimated as four days.

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[1]This is a by-product of work being done on the types of William H. Edwards's names for butterflies under National Science Foundation grant GB-194.

No.	Printed Date	Ackn. Date	Recipient	Publication Date
1	January 1872	15 April 1872	Stretch	5 April 1872
2	April 1873	18 May 1873	Edwards	14 May 1873
3	May 1873	21 June 1873	Edwards	17 June 1873
4	June 1873[2]	22 July 1873	Edwards	18 July 1873
5	July 1873	18 Sept. 1873	Edwards	14 Sept. 1873
6	August 1873	21 Oct. 1873	Edwards	17 Oct. 1873
7	October 1873	17 Dec. 1873	Edwards	13 Dec. 1873
8	1874	3 March 1874	Scudder	27 Feb. 1874
9	March 1874	12 May 1874	Scudder	8 May 1874
10	May 1874	1 Sept. 1874	Edwards	28 Aug. 1874
11	August 1874	2 Dec. 1874	Scudder	28 Nov. 1874
12	February 1875	22 May 1875	Scudder	18 May 1875
13	January 1876	24 Feb. 1876	Scudder	20 Feb. 1876
14	September 1877		ledger	18 March 1878[3]
15	November 1877		ledger	16 July 1878[3]

[2]On page 32 there is printed the date 10 June 1873. This probably is the date when the manuscript for number 4 was completed and sent to the printer.

[3]Strecker's ledger shows that he sent a copy of number 14 to Neumoegen on this date. All other mailings that are noted in the ledger, to Moeschler, Druce and Henley Smith, are dated 23 March 1878 or 26 March 1878 (to Ribbe). Scudder acknowledged receipt of the number on 26 March 1878 and his bill bears a printed date 19 March 1878. This is the earliest receipt I have found for a copy sent to a subscriber. On July 16, Strecker sent a copy of number 15 to Moeschler. This is the earliest date I have found associated with that number. Scudder acknowledged his copy on 10 August, 1878. Apparently Strecker did not distribute all copies at one time. Possibly he sent them off as he finished coloring the plates for a single copy of a number.

On the basis of the above data, the dates to be ascribed to the twelve butterflies named by Strecker in the fifteen numbers are these:

alma, Melitaea	16 July 1878
anticostiensis, Papilio	14 May 1873
astaroth, Satyrus	18 March 1878
guadeloupe, Charis	18 March 1878
fotis, Thecla	18 March 1878
hoffmani, Satyrus	18 July 1873
imitata, Melitaea	18 March 1878
kali, Thecla	18 March 1878
larunda, Melitaea	18 March 1878
larvata, Libythea	18 March 1878
similis, Pamphila	18 March 1878

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Edwards, William H. Manuscript letters in the Strecker Collection, Chicago Museum of Natural History.

Scudder, Samuel H. Manuscript letters in the Strecker Collection, Chicago Museum of Natural History.

Strecker, Herman. Manuscript ledgers in the Strecker Collection, Chicago Museum of Natural History.

Stretch, Richard H. Manuscript letters in the Strecker Collection, Chicago Museum of Natural History.

NOTES ON FIVE MEGATHYMIDAE

by Don B. Stallings, J. R. Turner and Viola N. Stallings

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Megathymus streckeri (Skinner): In 1895 Skinner described this species as a member of the genus *Aegiale*. He stated "This fine species is described from two males in my own collection; one is from Texas and the other probably from Arizona (the exact locality not being known in either case), and a pair in the collection of Dr. Herman Strecker, . . ." Several years ago Cyril F. dos Passos furnished us with photographs of the type of this species which is now in the collection of The Academy of Natural Sciences of Philadelphia. The photographs included the various labels on the specimen. One label has the following data: Arizona - Morrison - 1883, which would indicate that the type specimen was collected by Morrison in 1883 in Arizona. Another label indicates the type number to be 7053. In his description Skinner states ". . . in the female the five spots on the wing are in two series, the two upper being nearer the exterior margin, and the three lower are nearer the base; in other words, they do not form a continuous line as in the male." The five spots that he is referring to are the lower five spots on the upper surface of the primaries, which we usually refer to as spots 5, 6, 7, 8, & 9. The photographs of the type, which is a male, do not show these five spots to form a "continuous line" but are in "two series" the same as he describes the female to be. No doubt the Texas specimen before Skinner was *Megathymus texanus* (Barnes & McDunnough). The two specimens in the Strecker collection were collected in Texas and Colorado. Again the reported Texas specimen must have been *M. texanus*, the Colorado specimen a subspecies of *M. streckeri* or an undescribed species, for we have never found typical *M. streckeri* in Colorado. The Colorado specimen could be a *M. texanus*, as it occurs in the eastern part of the state. Regardless of what appears to be some variance in the description of *M. streckeri* and the location where collected, it is evident that the type specimen does represent a good species and we accept it as such. We collected a series of specimens on 25 May 1949 in the Petrified Forest National Monument in Arizona which we consider to be *M. streckeri*, as the males appeared to be identical to the type, both as to size and maculation. The type measures 66 mm. from wing tip to wing tip. Our males were only slightly worn and the females very fresh. In view of the foregoing we designate Petrified Forest National Monument, Arizona, as the type locality of *M. streckeri*. Females were observed

depositing their big green eggs on medium-sized plants of *Yucca angustissima* Engelmann.

Agathymus evansi (Freeman): During the last part of August in 1956 we collected a series of the pupae of this species in Ramsey Canyon in the Huachuca Mountains of Arizona. The pupae were all in *Agave parryi* var. *huachucensis* Baker. This plant is huge, compared to plants of typical *Agave parryi*. In the same area *Agave palmeri* Engelm. occurs. In this second plant we found larvae of *Agathymus aryxna* (Dyar). There was a third kind of *Agave* in the area that may have been another species, or a hybrid of the first two. In it were found some *A. aryxna*, but never *A. evansi*. The trap-door of *A. aryxna* is a dark brown to dull black, while the trap door of *A. evansi* is a bright shiny jet-black. Thus, while these two species resemble each other somewhat, they can easily be separated when collected as pupae and larvae by the food plant and the color of the trap-door.

Agathymus alliae (Stallings & Turner): In late August of 1961 we returned to the type locality to collect further specimens of this species. At the time we were there the larvae were just beginning to pupate. We discovered that we had been wrong in assuming that like *A. aryxna* and *A. neumoegeni* the larvae had a dormant period of from 30 to 60 days prior to pupating. Instead we found that the larvae continued to feed right up to the time of pupating, similar to *A. mariae* and its allied species.

Agathymus baueri (Stallings & Turner): The type series of this species was collected in 1950, 1952, and 1953. Most specimens were collected as larvae or pupae. In the original description we noted that the trap-doors of *A. baueri* were located so low on the leaf that the trap-door could not be seen due to the next leaf over-lapping the area. At the time the type series were collected all larvae and pupae were found in large plants. In August of 1961 we returned to the type locality to collect further specimens. We were amazed to discover that no larvae or pupae were to be found in the large plants. All specimens found were in medium-sized plants, and we were always able to see the trap-doors, though the trap-doors were still much lower on the leaf than are those of *A. aryxna*. Previously we had assumed that the females deposited their eggs only on the large plants. It now appears that they deposit them on all sizes of plants. Perhaps the difference in seasons or rainfall determines in what plants the larvae can survive. We have noted in the past that if the host plant has too much juice (probably controlled by rainfall), the new larvae will literally be washed out of their cavity by the flow of plant fluid. In the Chiricahua Mts. of Arizona in 1961 we noted the same change with *A. aryxna*. In 1950, 1952, and 1953 they

had all been in large plants, but in 1961 all were in medium-sized plants. This presents an interesting field project for someone to determine why the food plants used are large one year and small another.

Agathymus indecisa (Butler & Druce): This species is reported from southern Mexico southward to Panama. Several years ago specimens of this species were secured by the U. S. National Museum, Washington, D. C. William D. Field advises us that these specimens were from Costa Rica with the notation "Food-plant – cabuya leaves." *Furcraea cabuya* Trelease is a plant closely related to the *Agave*. It was first described from San Ramon, Costa Rica, and is commonly called "Central American sisal".

OCCURRENCE OF CERTAIN RHOPALOCERA IN OREGON AND WASHINGTON

by E. J. Newcomer

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The writer has done extensive collecting in Oregon and Washington for six seasons, principally east of the Cascade Mountains, and has been regional coordinator for the Northwest for the Season's Summary for 1961, 1962 and 1963, issued in the *News of the Lepidopterists' Society*. A considerable number of records which seem worth publishing has therefore accumulated.

Colias nastes Bdv. was reported from Washington (the first record for the United States) at Bunker Hill Lookout in Okanogan County by Shepard (1962), and it has also been taken on Windy Peak by Dan Carney and David McCorkle in 1962 and 1963. Both localities are within five miles of the Canadian Boundary and are at elevations of 7,000-8,000 feet.

Danaus plexippus L. is quite scarce in Washington. The writer collected in Yakima County during 1957 to 1960 without seeing it. Then it was taken in Cottonwood Canyon in August 1961 and seen there in 1962 but not in 1963. Specimens taken were quite fresh, so it evidently breeds here, and milkweed is common. It has been reported from the adjoining Benton County and in one or two other places in Washington, and has been seen occasionally at various localities in eastern Oregon.

Neominois ridingsii Edw. was taken by the writer on August 3, 1963, at 8,000 feet on Drake Peak, Lake County, Oregon. Four specimens were

taken and others seen on a grassy slope at about timberline. This seems to be the first record for Oregon. It probably occurs on other high peaks of the Warner Mountains in southern Oregon and northeastern California, and might also be in the Steens Mountains.

Polygonia faunus Edw. is common in Yakima County, Washington, and elsewhere in the Northwest at elevations of 3,500 to 6,500 feet. Dos Passos and Ehrlich (in Ehrlich & Ehrlich, 1961: p.149) say: "west to northern California."

Limenitis archippus Cram. occurs somewhat sparingly in the lower Yakima Valley of Washington. The caterpillars have been found there on willows. John C. Hopfinger used to take it on Okanogan County, Washington, and David L. Bauer has reported it from Morrow County, Oregon.

Limenitis bredowii Geyer. The writer has taken this in southern Oregon, and Stanley G. Jewett has reported its occurrence near Portland. It may even occur in southwestern Washington, altho there are no definite records.

Chrysophanus titus F. was fairly common along the west side of Summer Lake, Lake County, Oregon, in August 1962. It occurs sparingly elsewhere in eastern Oregon and Washington.

Satyrium fuliginosum Edw. The writer has taken this at Juniper Flat, Wasco County, in June, on Mt. Ashland, Jackson County, and at Drews Creek, Lake County, in July, all in Oregon. Clench (in Ehrlich & Ehrlich, 1961: p. 192) says: "strangely unreported from Oregon."

Satyrium behrii Edw. Records in addition to those published include Camp Sherman, Jefferson County, Davis Lake and Pringle Falls, Deschutes County, Skookum Meadow, Klamath County, and Silver Lake and Hart Mountain Antelope Refuge, Lake County, all in Oregon and all in July. So it is evidently fairly well distributed in that state. It is not nearly as common, however, as in Yakima County, Washington, where it is the most numerous theclid.

Satyrium sylvinus Bdv. Clench (in Ehrlich & Ehrlich, 1961: p. 195) says: "north possibly to Washington." It has not been seen in Oregon, but is found in Yakima County, Washington, where it is very common in restricted areas near willows. It has also been reported from near Wenatchee (Leighton, 1946), and Jones (1951) reports it from British Columbia.

Callophrys spinetorum Hew. Clench (in Ehrlich and Ehrlich, 1961: p. 207) says: "unreported from Oregon." The writer has it from Clackamas Lake, Clackamas County, from Big Summit Prairie and the Maury Mountains, Crook County, from Skookum Meadow and Miller Creek, Klamath County, and from Quartz Mountain, Lake County, all in Oregon,

collected in June and July. It is never common anywhere.

Callophrys johnsoni Skinner. Dornfeld (1959) reported that this species had been taken at Tombstone Prairie and Lost Prairie, Linn County, Oregon in 1959. The writer has collected at both places in July 1960, and several times in June and July 1961, 1962 and 1963, but has found no trace of it. As far as can be learned, no one else has taken it in these localities since 1959.

Lycaena cupreus Edw. has been taken in Oregon, at Gilchrist by Dornfeld, and at Skookum Meadow, Klamath County, and Big Summit Prairie, Crook County, by the writer. It occurs in British Columbia, according to Jones (1951), but curiously has apparently never been taken in Washington.

Lycaena editha Mead is very common in the Ochoco Mountains, Crook County, and also occurs in Wheeler, Grant, Lake and Lane Counties, and probably elsewhere, all in Oregon.

Plebejus shasta Edw. The writer has taken it in July at Cannon Well and Skookum Meadow, Klamath County, at Pringle Falls and Cultus Creek, Deschutes County, and on Drake Peak, Lake County, all east of the Cascades in Oregon.

Plebejus saepiolus Bdv. The range given by Downey (in Ehrilich & Ehrlich, 1961: p. 233) does not indicate this species west of the Rocky Mountains. It is quite common in various localities in Oregon and Washington. Specifically, it has been taken in Linn, Deschutes, Klamath, Lake and Crook Counties in Oregon; and in Okanogan, Chelan and Yakima Counties in Washington. Usually the females are the dark form which was named "rufescens" by Boisduval. Also, of course, it is common in California.

Apodemia mormo F. & F. Ehrlich and Ehrlich (1961) say: "exact northern limits in Great Basin need clarification." Opler and Powell (1961) have recently published a study of this species in which they record it from Okanogan, Kittitas and Yakima Counties in Washington. John C. Hopfinger told the writer once that it used to be very numerous in the vicinity of Brewster in Okanogan County. It is very common in several parts of Yakima County. On September 1, 1962, for example, 35 of the butterflies were counted feeding on the blossoms of a single Rabbit Brush plant (*Chrysothamnus nauseous*) near Tampico. It has also been reported from the Spokane area (Leighton, 1946), and David L. Bauer mentions taking it at Heppner, Morrow County, Oregon.

Heliopetes ericetorum Bdv. is sometimes described as an inhabitant of the Southwest. Holland (1931) says it "occurs in southern California, Arizona and Mexico." Comstock (1927) says "it ranges through the mountains of the southern half of the state" (California). Dyar (1902)

does give its range as "Pacific States." Jones (1951) does not list it for British Columbia. It does occur in Kittitas and Yakima Counties in Washington, and is usually rather scarce. But in 1960 it was very numerous and was ovipositing on the Globe Mallow (*Iliamna rivularis*). Leighton (1946) has reported it also from Okanogan, Pend d'Oreille and Whitman Counties, and Robert E. Miller has it from Dayton, Columbia County. David L. Bauer (Season Summary, 1962) reports it from Morrow County, Oregon. Since it flies in these localities from June to September, there are probably two broods.

Atrytone vestris Bdv. Comstock (1927) says this may occasionally be taken in California. The writer has a single specimen taken at Bird Creek, Yakima County, Washington, June 26, 1959.

Amblyscirtes vialis Edw. is found in northeastern California, according to Comstock (1927). The writer has not seen it there nor in Oregon but it is not uncommon in Yakima County, Washington, in June and has been reported from Mason County, in western Washington.

Pholisora libya Scud. The writer took what is probably this species at Ana Springs, Lake County, Oregon, on July 29, 1961, and also July 30 to August 3, 1963. It was fairly common on the blossoms of rabbit brush. Dornfeld has reported taking one specimen in the Steens Mts., Harney County, Oregon; and the writer took one in Surprise Valley, Modoc County, California, July 31, 1963.

Polites sabuleti Bdv. occurs late in the summer on lawns and in gardens in Yakima and nearby towns. It has not been seen in the country. The subspecies *tecumseh* Grin. occurs in Jefferson and Klamath Counties in Oregon.

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ESPECIALLY FOR FIELD COLLECTORS

(Under the supervision of FRED T. THORNE, 1360 Merritt Dr., El Cajon, Calif., U.S.A.)

NOTES ON THE USE OF BUTTERFLY TRAPS IN EAST AFRICA

by ARTHUR RYDON

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During the last fifteen years increasing use has been made by East African lepidopterists of specially designed traps for catching those spectacular "eagles of the entomological world" – the *Charaxes* (Nymphalidae). These splendid butterflies are normally very difficult to catch with an ordinary net owing to their extreme wariness and swiftness of flight, and their tendency to stay well out of reach of the net at, or near, the tops of the tallest trees. Even when they are feeding at fermenting exudates on trees and bushes, or on rotting fruit or the excrement of certain animals on the ground, they are not easy to approach or to capture, as any sudden movement will send them off in a flash of color to some high vantage point and safety. *Charaxes,* however, will come readily to baited traps, for which they seem to have a marked predilection. They do not encounter much difficulty in finding their way into traps, because in the wild state they are accustomed to making their way through interlaced twigs and branches to get at fermenting oozes resulting from infection of trees and bushes with coleopterous, dipterous or moth larvae. After entering a trap and feeding on the bait, the majority of *Charaxes* will then fly up vertically to the top of the trap, where, after flying about vigorously for a minute or two, they will come to rest with their wings closed. They will remain like this for hours at a time, unless the trap is suddenly shaken or roughly handled, when they will immediately come to life and batter themselves in all directions with considerable violence in an effort to escape, which they will do easily unless the trap is quickly closed.

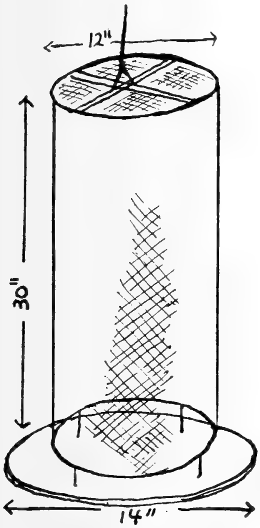
Although butterfly traps were specifically designed for catching *Charaxes,* they can be used with almost as much success for trapping many other genera of Nymphalidae, as well as some of the Satyridae, Libytheidae and Riodinidae. Also, if they are baited with fermenting fruit and are left out of doors overnight, they can be used as moth traps, since noctuids and other fruit-sucking moths will be attracted to them. Hence, for the butterfly collector in East Africa at any rate, traps have become an important item of his field equipment, for the more traps he uses in the field the greater will be his reward. Furthermore, the use of traps will free him from having to waste his time trying to capture some of the more elusive butterflies and will allow him to

concentrate on the more tractable genera. Another advantage of traps is that they can be left out all day unattended in one's garden or elsewhere, and the butterflies captured by them can be removed at one's leisure at the end of the day. In this way one can go out to work or attend to some other business and still collect butterflies. Although this kind of "armchair" collecting is somewhat limited in its scope, it can, nevertheless, be quite a rewarding one in a country the size of East Africa where, for example, there are more than a hundred species and subspecies of *Charaxes* to be found, apart from all the other many genera of butterflies that will also come to traps. If one travels widely in this area and uses traps in the varying climatic and ecological zones of which the area consists, one should, within a year or so, capture most of the *Charaxes* inhabiting such zones, whereas in the days prior to the introduction of traps it would have taken a life-time to do so. In fact, a new type of collector is beginning to emerge these days, one who seldom if ever uses an ordinary butterfly net and instead only uses traps. Such a person is usually interested solely in the *Charaxes*, and there are good reasons for his being so, as there are still the odd species and a number of geographical races of this interesting genus to be discovered in East Africa, and much information is yet to be acquired regarding their distribution and, in some cases, their food-plants and early stages of development.

Butterfly traps first made their appearance in East Africa a few years after the last war, when two types of traps were introduced more or less simultaneously. These were the East African hanging-trap and the Rhodesian ground-trap. The former was invented by Mr. John G. Williams of the Coryndon Museum, Nairobi, Kenya, who developed his trap between the years 1947-9 from the common or garden fly-trap used by the British Army in the field during the last war. His trap (Fig. 1) consists of a net 30″ in length, which is closed above and below. The net incorporates two circular wire frames, 12″ in diameter, of which one is at the top of the net and the other is at the bottom of it. A circular wooden or hardboard platform, 14″ in diameter, is suspended on four pieces of string from the lower frame of the net, giving a clearance of an inch or two between platform and net. The trap is hung from an overhanging branch of a tree or bush a few feet off the ground by a cord attached to the upper frame of the trap. A bait is placed under the net at the center of the platform, either on the board of the platform itself, or in a shallow receptacle which can be kept in position with chewing gum or plasticine. Butterflies which are attracted to the bait will first alight on the net or the platform of the trap, and will fly or wander around the trap until they have found the entrance to it. The

larger *Charaxes* will force their way into the trap by leaning over sideways. The trap can be closed by raising the platform with one hand, while with the other hand the thoraces of the butterflies can be pinched through the net from outside it to stun them, after which they can be

1



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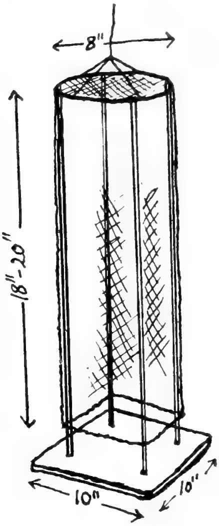

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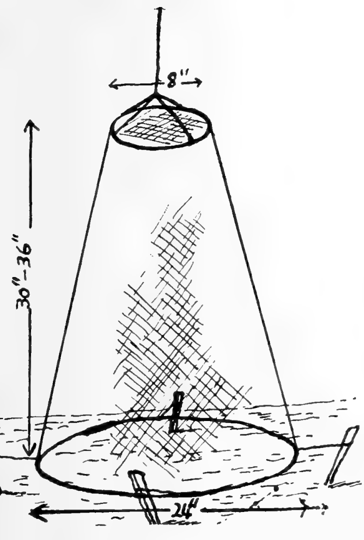

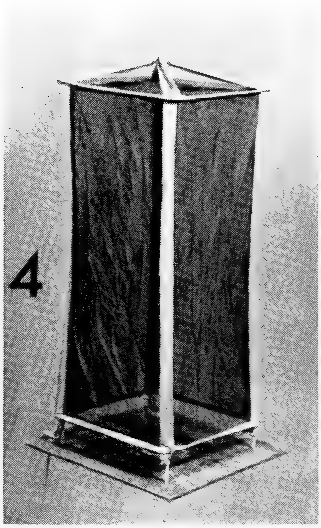

Fig.1. East African hanging-trap. Fig.2. Dr. V. G. L. van Someren's hanging-trap. Fig.3. Rhodesian ground-trap. Fig.4. The author's trap.

transferred to a killing jar.

The disadvantage of this trap is that one cannot insert a killing bottle into the lumen of the net owing to insufficient clearance between the net and platform, nor can one insert one's hand or forearm into it easily in order to remove live specimens for breeding or other purposes. These difficulties have been overcome by a hanging-trap designed by Dr. V. G. L. van Someren of Ngong, Nairobi, whose trap (Fig.2) is constructed so that the platform hangs on four equal lengths of string or, preferably, plastic-insulated electric flex (which does not rot) attached to the upper circular wire frame. The lower frame has been dispensed with, and instead the net is pulled down the outer sides of the strings or flex, like a sleeve, to within an inch or so of the platform. (The net or body of the trap can also be made of tubular polythene instead of mosquito netting). It is eary to insert a killing jar into this trap as the netting or polythene will move up the strings with the hand or forearm, but while carrying out this maneuver it is necessary to constrict the lower part of the net with one's free hand to prevent the butterflies from escaping from the trap. The dimensions of Dr. van Someren's trap are as follows: the circular wire frame is 8″ in diameter, and the length of the net is 18″-20″. The platform is 10″ square. There is little doubt that this trap is one of the simplest and most effective traps yet designed for catching butterflies and, what's more, it is relatively easy to construct.

But for trapping low-flying nymphalines such as the elusive and colorful *Euphaedra, Euryphene* and *Euryphura* (of which there are many fine species in some of the west Kenya and Uganda forests) the Rhodesian ground-trap is hard to beat. This trap was brought to East Africa from Southern Rhodesia by Dr. Elliot Pinhey in 1949, when he took over the entomological section of the Coryndon Museum, Nairobi. It was invented by the late Mr. E. W. Lannin of Southern Rhodesia, who first started trapping *Charaxes* by suspending an ordinary butterfly net over a bait laid on the ground. The trap which was developed from this, and which in fact is simply a modified butterfly net, was described by Mr. D. G. Sevastopulo in the *Lepidopterists' News* (vol.8: p.26; 1954). I was introduced to this trap by Dr. Pinhey in 1950, and will briefly redescribe it for the benefit of readers who have not read the original description of it. The trap (Fig.3) consists of a cone-shaped net which is closed above and open below, and incorporates a circular wire frame 6″ to 8″ in diameter at the top of the net and a larger one of 18″-24″ diameter at the bottom of it. The length of the net is 2½ to 3 ft. This large trap is suspended an inch or two above and directly over a bait laid on the ground, a cord being attached to the top of the net and tied to a branch of a tree to effect this. The trap is anchored in position,

to prevent it from swaying in the wind, by pieces of string tied to the lower rim of the net and attached to pegs or stakes hammered into the ground round about it. I have found this trap to be an effective method of catching *Charaxes* as well as the low-flying forest nymphalines already mentioned. Also satyrines will come to it readily. Occasionally the odd lycaenid or *Acraea* will be captured by this kind of trap if the bait consists of fresh animal dung, and the soil around it is moist or muddy.

The above trap, however, has several disadvantages which hanging-traps do not have. It is somewhat cumbersome to use in the field as it has to be dismantled everytime one wishes to remove a butterfly from it. It also takes much longer to set up than a hanging-trap, and occasionally it is impossible, owing to the nature of the ground, to anchor it properly. If the net is allowed to sway too much in the wind it ceases to function as a trap. Another disadvantage is that the bait, being on the ground, is easily tampered with by other insects such as ants and beetles, etc., and if the bait being used is fermenting fruit, animals such as squirrels, monkeys and baboons will help themselves to it, unless they are prevented from doing so by ceaselessly patrolling and guarding the area.

The trap shown in the photograph (Fig.4) is one which I myself have been using in more recent years. It was developed by myself from the Rhodesian ground-trap with the object of getting the bait off the ground for the reasons stated above. It can be used as a hanging-trap or a ground-trap by raising it or lowering it as required. The net consists of green cotton mosquito netting which is strengthened by strips of khaki sewn along all its borders. All materials used in the construction of the net should, of course, be pre-shrunk, otherwise the net will tear when it gets wet. The net of the trap is 11″ square, and incorporates a strong wire frame above and below. The platform is 14″ square, and is suspended an inch or two from the lower frame on four pieces of string which are passed through holes in the platform and are knotted underneath it. To catch low-flying butterflies with this trap it is necessary to lower it so that the platform is just touching the ground, and the strings of the platform should be adjusted so that one side of the trap is closed. This will prevent too many of these butterflies from escaping from it, as they do not fly upwards into the trap as readily as the *Charaxes*.

One's success in the field with traps, however, does not depend so much on the type of trap one is using as the kind of BAIT one is using. In East Africa, fermenting banana is mainly used as bait, although fermenting pineapple, wild figs, mangoes and guavas can be used

effectively also. These fruit baits will attract both males and females of the many species of butterflies that are attracted to such substances. Rotting meat, chicken or fish entrails, or the droppings of carnivore animals (including those of field collectors who consume plenty of meat in their diets) can be used for attracting MALE *Charaxes*. Leopard droppings are particularly attractive to the latter, more so than anything else. If one is using bad meat and excrement as baits it is preferable, from a hygienic point of view at any rate, to put such baits on the ground away from human habitation and suspend Rhodesian ground-traps over them. *Charaxes* of both sexes often prefer the ferments of exudates on trees and bushes to fruit bait, and it is sometimes possible to excise a piece of infected bark and use this as a bait in a hanging-trap. Some collectors prefer to use "compound" baits in their traps, composed of fermenting fruit, beer or rum, and sugar with or without the addition of a little tincture of valerian; but experience shows that these baits, apart from being more troublesome and expensive to prepare, are really no more efficacious in practice than fermenting fruit by itself. One incident, however, that happened to me when I was stationed at the British Military Hospital at Mackinnon Road in 1950 seems to indicate that a compound bait, if it contains the right ingredients and is correctly prepared, can nevertheless have a devastating effect on *Charaxes*. I had been advised by Dr. Pinhey to try out a bait made of fermenting mashed bananas, beer and sugar; so, having brewed up these ingredients for three days in a tin, I decided to try out the bait on the *Charaxes* of the arid thorn-bush country in which the hospital was situated. I walked out into the bush and laid my baits in a number of places. (I did not possess any traps at the time.) No sooner had the first bait been laid than the *Charaxes* started wheeling down in large numbers literally "out of the blue". Soon my baits were covered with masses of these wonderful butterflies, battling with one another for footholds on the nauseating brew; many of them became so drunk they were incapable of standing upright or flying. Although I had a net with me, it soon became unnecessary to use it, as all I had to do was to kneel down by a bait and pick up any specimens I wanted in my fingers. The thing that really surprised me about this incident was not the effectiveness of the bait so much as the large number of *Charaxes* that appear to inhabit semi-desert, thorn-bush country. (Mackinnon Road is shown on the maps as being in the TARU DESERT.)

Recently, I have been in the habit of using fourteen traps baited with fermented bananas, and have on a number of occasions come home from a day's collecting with more than one hundred *Charaxes*

"in the bag". I have also on several occasions caught TWENTY different species of *Charaxes* in one day. This is possible if one places traps in a number of different ecological zones, such as at the base of a mountain and up its slopes until one reaches the higher montane forests. The more traps one has out and the larger the area one covers the greater will be one's reward. But collecting *Charaxes* on as massive a scale as I have occasionally been guilty of is seldom justified. Too much trapping by too many collectors in a given area could in a very short time decimate the population of these fine butterflies, and would no doubt wipe out completely some of the rarer, more localized species. Traps must be used judiciously by collectors, and not abused by them.

When traps are placed in open savannah or thorn-bush country, apart from the *Charaxes* inhabiting such places they will attract other nymphalid genera such as *Hamanumida, Neptis, Byblia* and *Precis,* as well as such satyrines as *Melanitis, Henotesia, Ypthima* and *Mycalesis.* In forests, however, the following genera will come to traps:

Family NYMPHALIDAE

Charaxes	*Ariadne*
Palla	*Byblia*
Euxanthe	*Neptidopsis*
Cymothoe	*Eurytela*
Euptera	*Kallima*
Euryphura	*Apaturopsis*
Diestogyna	*Hypolimnas*
Euryphene	*Salamis*
Euphaedra	*Catacroptera*
Aterica	*Precis*
Pseudargynnis	*Vanessula*
Pseudacraea	*Antanartia*
Neptis	*Lachnoptera*
Cyrestis	*Phalanta* (=*Atella*)
Asterope (=*Crenis*)	

Family LIBYTHEIDAE

Libythea

Family RIODINIDAE

Abisara

Family SATYRIDAE

Elymniopsis	*Mycalesis*
Melanitis	*Henotesia*
Gnophodes	*Ypthima*

From the foregoing it can be seen that the use of traps represents a major "breakthrough" for the field collector in East Africa and has

added a new dimension to butterfly collecting. The modern collector has learned that he must use traps if he is to benefit fully from his efforts in the field. Although in this paper I have dealt with traps in an East African context only, there is little doubt that they could be used with equal success in other parts of the world to catch genera similar to, or closely related to, the ones listed above.

ACKNOWLEDGEMENTS

In conclusion, I should like to thank Dr. V. G. L. van Someren, Dr. Elliot Pinhey and Mr. John G. Williams for data regarding butterfly traps and baits, and Messrs. D. G. Sevastopulo, R. T. Evans and B. Barton-Eckett for their advice and help in the preparation of this paper.

KEEPING RECORDS

by L. P. GREY

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The lepidopterist first of all is a psychopath of sorts; he needs must be individual and of course his ways of handling data will be diverse — witness the awesome ingenuity he displays in his other gadgetries and techniques of collecting. The nearest thing to agreement on a standard approach to data-keeping probably has been through the medium of personal diaries, at least with the older generation. This habit of chronology soon grows to be an indispensable crutch, a key to lifetime observations, especially functional when need arises to determine the particular housing project or cloverleaf under which lie buried the fields of youth and the butterfly haunts of yesteryear.

Ease and accessibility of recall are prime functions, but they are governed by what is to be recalled and for what purpose. Purpose indeed ranks first in any critique of method — the diary and the computer tape both are means to an end, whether the end be nostalgic or scientific.

The record chart forms recently shown by Heitzman in this section of the *Journal* (vol.17: 44-46; 1963) appear well suited to or adaptable to the needs of a large class of collectors, namely, those who do not happen to own a late-model computer but yet would like to get around some of the obvious defects of the diary-notebook system, aiming toward a better grouping of related data.

But alas, collectors being what they are, it is a safe wager that Heitzman's excellent layout will suffer many a change if it is "copied" at all by other students. Recognizing this fact of life, I shall describe my own scheme of filing data merely with the hope of provoking con-

tinued discussions anent this important subject; privately, I realize my ideas are outstandingly superior but I also have a suspicion that no properly classified member of the "genus collector" is about to be copying either my methods or purposes — I had as soon think they would be rushing to wear my shoes which so nicely fit my individual pedal bumps and callosities.

My record file is limited to the named and unnamed color forms and blendings of the Nearctic fritillaries. It is maintained primarily as a tool to aid in visualizing distributions. "Localities", however, are treated merely as a convenient category around which to integrate other coequal data, viz: (1) of sympatrisms and allopatrisms; (2) of ecology — as defined by plant associations, altitudes, photographs when possible; (3) flight seasons, relative abundances and other noted biological individualities; (4) the usual "where, when, by whom", plus notes to help relocate collecting sites & material; (5) some description of local variation & population structure.

One of the functions of a record set-up surely ought to be to allow fairly quick extraction of listed data in many different combinations and permutations. Probably the speed with which this can be done, weighed against cost and amount of labor needed to prepare the file and keep it in order, give the true measure of utility. It would be nice to have answers pop up at the push of a button, but then, the main thing is to have quick access to particular cards from which desired combinations of information can be had, or at least to learn quickly how many of the desired facts are at hand.

I have seen no reasons to regret the decisions I made when adapting a system to 3×5 file cards. I gave serious consideration to many ways of handling, including mechanical adjuncts such as, *e. g.*: notching the cards to allow various automatic collations when dropped onto spaced rods — these and other grandiose ideas were discarded in favor of manual sorting. This meant that special care must be given to layout and organization since I expected to build up a fairly large body of assorted information which would be valuable only in proportion as it could be collated and cross-compared. It appeared that this could be done by exploiting two simple ideas, namely (1) that alphabetically arranged index tabs for various categories are easy to prepare and easy to discriminate when a drawer is opened, and (2) that a bunch of cards of this size is easy to hold and to RIFFLE so that the CORNERS pass in review for quick sighting.

I recognize thirteen "species" in the group I study; the first categorical separation therefore is by "species", or rather by "drawers" since I have enough records in most of these categories to require a separate

drawer or drawers for each, all of which are at arm's reach in a specially constructed desk. The next category, within drawers, is "States and Provinces", instantly selective from alphabetically ordered tabs. A subcategory of "Counties" is maintained at present merely by alphabetical arrangement within each of the "species-States" slots, subject to promotion whenever I get enough material, or spare time to make the tabs. As it stands, then, it takes only a few seconds to pull out whatever records may be available of particular species from any county in North America. But this is only a first step; the card layouts then permit reasonably quick tabulations, comparisons and other developments of the data.

A description of the format follows, but a prime qualification must not be omitted: I should define my "units" to which separate cards are assigned. These are: SERIES OF A PARTICULAR SPECIES TAKEN BY AN INDIVIDUAL COLLECTOR OR COLLECTORS IN A SPOT LOCALITY ON A SINGLE DATE. "Localities" are closely restricted; correspondents are asked to assign separate field numbers when they move on a mile or two or revisit places at later dates.

When the cards are typed, places of honor are given to data adjudged most often consulted or most likely to require tabulation; these are spotted in the four CORNERS, viz.:

Upper Left: SPECIES. And also, for convenience, FIELD NUMBERS are placed here, a line or two below, plus CROSS REFERENCES where available. Example:

atlantis
AHM 63 AO
see also
AHM 63 BX – RHP 61 AR

Incidentally, it might be a cause for rejoicing if collectors would standardize on this formula of "initials of collector – year – AA through AZ, BA through BZ, etc.", a concise and inexhaustable code providing every spot locality batch with its own unique tag.

Upper Right: STATE OR PROVINCE. Immediately below this, the COUNTY, and just below this usually a TOPOGRAPHICAL CATCH-PHRASE. Like this:

Wyoming
Albany Co.
S. E. Laramie Divide,
Dale Creek-Cache
la Poudre drainage

The latter reference quite often is the most importantly useful one on the card; some regional research should be put into selecting and

phrasing it. Notation of the nearest mountain range or other principal topographic feature usually is inadequate unless restricted; the form of restriction should be the one most likely to aid in rationalizing subspeciation in terms of the lay of the land. Take for example the cited instance: the highlands and Sonoran intervales of southeastern Wyoming and adjacent parts of Colorado are fairly complex, especially so to a stranger; it then appears safer to go by drainage lines which in this case probably are equally or better calculated to integrate observed variation and which have a special virtue of being easy to check definitively whereas the upland contours are rather bewildering to follow on ordinarily available maps. Political units like "Albany County" are extremely valuable in preliminary delimitations but then the orientation properly must be to ecogeography, to have, say, the "Medicine Bow East Slope – Little Laramie River drainage" records grouped so that they comprise units within the "Albany County" assortments.

Lower Left: DEPOSITION. The name of museum or individual owner of recorded material is placed here for my own convenience, since I often like to know where certain series may be located. But this "quick-sight" space could as well be given to some other phase of data, dependent on individual needs and desired utility; the same flexibility could be given to the next and final "cornering".

Lower Right: NUMBER OF EACH SEX. Also, a line above or nearby: CONDITION, whether fresh, worn or ragged, and RATIO OF SILVER if the record is of a population in which that character is variable.

But these "cornerings" merely frame the subject; major data fill the centers of the cards, often running over to the reverse sides, in this order: (1) a LOCALITY REFERENCE is given in some terms which will insure limitation to the proper U. S. G. S. quadrangle map and which will further aid precise or within-a-mile-or-so spotting (often, reference to available National Forest maps, air navigation charts, etc., is inserted – capitalized for quick sighting – since these can be exhumed quickly and usually will be sufficient to give the desired perspective); (2) all in one running statement, the ALTITUDE, DATE AND COLLECTOR are cited (the latter by initials merely if the same person owns the material and is named in the lower left corner); (3) next, separated by a line, a LIST OF CONGENERS, that is, the number and identity of all other speyerians taken at this same place; this facilitates cross-reference to the other cards of the same catch and at the same time nails down the recorded sympatrisms of particular localities; (4) then, the ECOLOGICAL NOTES, carefully boiled down to essentials (if you can close your eyes and visualize the place, your choice of words

was right; (5) finally, a DESCRIPTION OF VARIATION which again need not be wordy to stimulate recall.

A representative fill-in of the above might look like this:

> Albany Co. Laramie Divide, N. E.
> No. Laramie-No. Platte drainage
>
> Along Friend Creek in a large dry meadow just West of Laramie Peak (MED. BOW N. F.), 7800 ft., 20.vii.63, AHM. On thistles (ECOLOGY: see *atlantis* file).
>
> *Sympatric*: 1 m *egleis;* 3 m, 5 f *atlantis* unsilvered; 11 f *coronis;* 3 f *edwardsii;* 14 m, 12 f *zerene.*
>
> These *mormonia* silvered, the female very green-disk, the males greenish to very red like Black Hills norm, a stunning contrast.

Perhaps a few more trivia should be noted. (1) Having given considerable attention to ecology, I have been lead to preserve rather lengthy descriptions, photographs, references to correspondence, etc., which would be time-consuming or impossible to duplicate for the separate files of species taken in single places. These, then, are tied together by cross-references, as in the above example. On each card, however, the intention is to make them practically self-sustaining for generalities of faunal zone and vegetation. Probably the available ecological notes will be organized in a separate file eventually, but as it stands it is no great chore to pull things together when needs arise. (2) A date of filing is rubber-stamped vertically across the left-hand end of the cards, a date which is kept the same for and unique to all cards of particular loans and shipments; perhaps this is an unnecessary refinement but it does make possible eventual reassembly of all data of particular shipments if it ever should be required. (3) in addition to mentioned recordings other facts often are added as occasions seem to merit; for example, the entire file originally was confined to personally inspected series, but the circumstances which made that necessary have changed greatly in recent years; there are now many keen students of these butterflies whose identifications can be accepted without question. In such cases the cards are marked "not seen; data from Richard Roe *in litt.* 6.ix.61".

As a usual thing, regardless of the problem at hand the records available are not likely to swamp one, once they are located. And if the research is extensive it can be broken down geographically and worked piecemeal. The broad principles of this sort of record-keeping do not require elaborate means for collating data. It is true that a large number of cards may have to be conned over when making desired factual syntheses, but the geographically organized arrangement usually per-

mits very speedy access to exactly those cards which will be needed. I anticipate that everybody who dabbles in biogeography will agree that the procuring and organizing of good maps is more of a problem than the one of organizing records. It is to be hoped that some of the brethren who have ideas on this latter subject of gathering, learning and organizing data of ecogeography will speak up!

More and more, my file of *Speyeria* grows to command the time and interest I once gave to a "collection"; the latter now serves the frankly subsidiary purpose of providing an occasional jog to memory of local variation. Time is becoming too precious to waste on the mechanics of case-building and spreading; also, my wife intimates that one roomful is enough. But file cards are inexpensive and some of the available drawers still are empty. Still and all, how nice it would be, as W. D. Field and I so often have wistfully pondered, if some genius would engineer a transparent-envelope system of some kind, so that all of the series could be put right in the drawers with the cards – thousands of them in space where at most a few dozen pinned specimens could be housed.

Until the happy day comes when this urgent problem is solved, of filing Lepidoptera in quantity in some way so that they can be (1) quickly and inexpensively prepared, (2) stored in small space, adaptable to a filing cabinet system, (3) available for close inspection, fully visible, (4) exposed to repeated handling without damage, and (5) easily withdrawn for microscopic examination, I suppose we still must abide by the curatorial traditions handed down from the Victorians. But I will say that of the two things, I almost prefer a well-organized file, if the choice has to be between it and pinned series of the all-too-usual kind, which are alone in the world except for pin labels telling the place, day, and COLLECTOR. The latter's name usually is set in fairly large type and if he is still living there is a chance that a few man-hours of research and correspondence might yield the desired graphic data of ecogeography and sympatrisms. But then, the same amount of effort probably would bring in better and larger data from contemporary correspondents. Still, the standards are visibly improving, and the main troubles lie with existing series which are relics from days when "specimens" were thought to be the goal and end of collecting. The search now has passed on to the pursuit of elusive truths concerning the age-old evolutionary struggle, for hints which now and again may be interpreted from the data of landscapes and populations. This sort of "collecting" challenges today's students to improve their techniques of record-keeping and to pioneer new and more efficient ways of handling material.

AN ALBINO MALE *EUREMA LISA* (PIERIDAE) COLLECTED IN MISSOURI

On 16 September 1963 I had the unique experience of capturing an albino male *Eurema lisa lisa* Boisduval and Leconte. The specimen was taken fluttering by the side of an old railroad track near Atherton, Missouri. In this area *Eurema lisa* migrates north each season in June and produces two or three broods in our region. The numbers fluctuate greatly from year to year and this summer the species was quite common. I probably saw forty or more during the course of the day. When I saw this white one flying by I took it to be an albino female. Pure white females are very rare in this area, and luckily so, for otherwise I would have passed this one up. Since I have never seen or heard of an albino male being taken before, I thought this record might prove interesting to other collectors. The specimen possesses the normal black borders with a white ground color on the upper side. Beneath, the ground color is white with the normal brown markings reduced and of a silvery gray tone.

RICHARD HEITZMAN, 3112 Harris Avenue., Independence, Mo., U. S. A.

EDITORIAL

As of this Volume, Dr. Charles L. Remington steps aside as editor of the *Journal,* after 17 years of work, not only as editor, but as general manager of the organization's affairs. With the change the Society enters a new era and must assume new responsibitities as a self-sufficient operation not dependent on the efforts of one man.

The Lepidopterists' Society was founded and a mimeographed newsletter initiated in 1947 by Remington and Harry K. Clench, while both were graduate students at Harvard. *The Lepidopterists' News* evolved to a lithographed publication the following year and to a formalized letterpress periodical in 1951. Ultimately the growing Society, under the guidance of Remington, expanded its publication, replacing *The Lepidopterists' News* with a litho printed *News* and the present quarterly *Journal of the Lepidopterists' Society* commencing with Volume 14 in 1958. During 18 years the Society has grown from an idea and the enthusiasm of a few persons to some 750 members and subscribing Libraries representing countries in all parts of the world.

The Society has from the beginning had as its aim the promotion of free interchange among lepidopterists of all countries, both professional and amateur; a high proportion of the membership has been non-professionals, who have found a medium for communication with current trends in the study of Lepidoptera. Entomological journals in general experience the paradox of having editors who are trained as research biologists rather than as editors, except by experience. These editors are not paid and are seldom thanked for their efforts; the time donated must be subtracted from that available for the research for which they are trained. Moreover, contributors to these journals are for the most part trained as research biologists and not as writers, except by experience. Thus problems associated with editing and with author-editor relationships probably exist over and above those normally encountered by professional editors.

In the case of this journal, the high proportion of non-professional contributors often trained neither in research nor in writing, has undoubtedly compounded these problems. Accordingly, the criticism characteristically directed towards editors has been abundant in Dr. Remington's situation, I am sure, particularly from those with less publishing and no editing experience. However, we as members, critics and non-critics alike, should acknowledge the debt of gratitude which we owe him. The Society and its journal owe their existence to the efforts of Charles L. Remington.

NOTICE TO CONTRIBUTORS TO THE *JOURNAL*

Contributions to the *Journal* may be on any aspect of the collection and study of Lepidoptera. Articles of more than 20 printed pages are not normally accepted; authors may be required to pay for material in excess of this length. Manuscripts must be typewriten, ENTIRELY DOUBLE SPACED, employing wide margins and one side only of white, 8½ x 11″ paper. The author should keep a carbon copy of the manuscript. Titles should be explicit and descriptive of the article's content, including an indication of the family of the subject, but must be kept as short as possible. Authors of Latin names should be given once in the text. Format of REFERENCES MUST CONFORM TO EXACT STYLE used in recent issues of the *Journal*. Legends of figures and tables should be submitted on separate sheets. Authors are normally charged for engraving and tables at cost.

Reprints may be ordered, and at least 25 gratis separates (including any other material published on these pages) will be provided, if requested at the time galley proof is received.

Address correspondence relating to the *Journal* to: Dr. J. A. POWELL, 112 Agriculture Hall, University of California, Berkeley, Calif., U. S. A.

Material not intended for permanent record, such as notices, current events, anecdotal field experiences, poems, philatelic Lepidoptera, etc. should be sent to the *News* Editor: Dr. J. W. TILDEN, 125 Cedar Lane, San Jose, Calif., U. S. A.

Address remittances and address changes to: GEORGE EHLE, 314 Atkins Ave., Lancaster, Penna., U. S. A.

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THE LEPIDOPTERISTS' SOCIETY

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and *ex-officio*: the above six elected Officers and the Editor

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The object of The Lepidopterists' Society, which was formed in May, 1947, and formally constituted in December, 1950, is "to promote the science of lepidopterology in all its branches, ... to issue a periodical and other publications on Lepidoptera; to facilitate the exchange of specimens and ideas by both the professional worker and the amateur in the field; to secure cooperation in all measures" directed toward these aims (*Constitution*, Art. II). A special goal is to encourage free interchange among the lepidopterists of all countries.

Membership in the Society is open to all persons interested in any aspect of lepidopterology. All members in good standing receive the *Journal* and the *News of the Lepidopterists' Society*. Institutions may subscribe to the *Journal* but may not become members. Prospective members should send to the Treasurer the full dues for the current year, together with their full name, address, and special lepidopterological interests. All other correspondence concerning membership and general Society business should be addressed to the Secretary. Remittance in dollars should be made payable to *The Lepidopterists' Society*. There are three paying classes of membership:

Active Members — annual dues \$6.00 (U. S. A.)

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Dues may be paid in Europe to our official agent: E. W. Classey, 353 Hanworth Road, Hampton, Middx., England.

In alternate years a list of members of the Society is issued, with addresses and special interests. All members are expected to vote for officers when mail ballots are distributed by the Secretary annually. There are four numbers in each volume of the *Journal*, scheduled for February, May, August, November, and eight numbers of the *News* each year.

The Lepidopterists' Society is a non-profit, scientific organization. The office of publication is New Haven, Connecticut (see address inside back cover). Application for Second-class mail privileges has been approved at New Haven, Connecticut.

JOURNAL OF THE LEPIDOPTERISTS' SOCIETY

Volume 18 1964 Number 2

THE LIFE HISTORY OF *PAPILIO INDRA MINORI*

by JOHN F. EMMEL and THOMAS C. EMMEL

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One of the rarest of all North American butterflies is the narrow-banded subspecies of *Papilio indra* Reakirt occurring in the wild mesa country of western Colorado. Described by Frank C. Cross in 1937, this subspecies was named *Papilio indra minori* in honor of the discoverer, Mr. Will C. Minor of Fruita, Colorado. Since that time, apparently less than one hundred adult specimens have found their way into collections. The habits of the adult butterflies have been described in engaging and thorough detail by Donald Eff (1962), the other lepidopterist besides Will Minor who has had the most experience with this rarity. Until 1963, however, the food plant and life history of *P. indra minori* were undetermined. The present paper reports the food plant and describes the egg, larva, and pupa of the insect from material collected in the type locality.

GENERAL REMARKS

The home of *P. i. minori* is along the edge of Black Ridge, near Colorado National Monument in Mesa County, Colorado. While at Black Ridge on May 12 and 13, 1963, Don Eff collected two females; one of these was caught *in copula*. Since the freshly mated female would produce more eggs than an older and possibly unmated female, and kindly answering a standing request, Mr. Eff sent the mated female to us, and on May 16 it was confined in a net bag placed over a growing plant of *Tauschia arguta* (Umbelliferae), a known food plant of *P. indra pergamus* Hy. Edw. (Emmel & Emmel, 1963). On alternate days, the female was transferred to a net bag placed over *Foeniculum vulgare*, another umbellifer used as a laboratory food plant for *Papilio bairdii* Edwards, *P. oregonius* Edwards, and *P. rudkini* Comstock (Emmel & Emmel, 1963). Before dying after six days, the female laid a total of 30 eggs; all were oviposited on the *Tauschia* plant. Unfortunately, the eggs proved to be infertile.

As the adults' flight period is restricted to late April and May, it seemed probable to us that advanced larval stages might be found on some umbellifer around Black Ridge in the early part of June, since the eggs of other *P. indra* subspecies — always laid on umbellifers — develop immediately and the insects go through a winter diapause in the pupal stage. Accordingly, after correspondence with Will Minor and Donald Eff, we met Mr. Minor at his home in Fruita on the afternoon of June 16, 1963. He generously consented to take us to Black Ridge in his Jeep, and we arrived at Coal Mine Point, the type locality, at about 4:00 p.m., where we began an immediate search for the food plant.

DESCRIPTION OF FOOD PLANT AND HABITAT

Eff (1962 and *in litt.*), by process of elimination of plants in the local flora, had suspected the food plant to be *Lomatium grayi* (Coult. & Rose), an umbelliferous species generally distributed over western Colorado from four to eight thousand foot elevations. However, the umbellifer Eff found at Black Ridge may have been misidentified by the botanist who examined his specimens, since another species, *Lomatium eastwoodae* (C. & R.) Macbr., turned out to be the only *Lomatium* species we could find at Coal Mine Point. This plant, *Lomatium eastwoodae,* was discovered to be the food plant of *P. i. minori.*

The *Lomatium* species at Black Ridge keyed out as *eastwoodae* in Mathias (1938) and in Harrington (1954). The identification was further verified by comparison with *L. eastwoodae* specimens (sheet no. 330463) in the Dudley Herbarium at Stanford University, which were labeled as having been collected at "e. edge of Black Ridge, Colo. Nat. Mon., Mesa Co." According to Mathias (1938), *L. eastwoodae* was known only from the type locality ("near Grand Junction, Colo."). Because of the great rarity of this plant and the lack of readily accessible published descriptions and herbarium specimens, a description follows and an illustration of a single plant with fruiting umbels is provided herein in Figure 12.

DESCRIPTION OF FOOD PLANT: The plants are about 10 to 15 cm. tall from "a subwoody caudex covered with old leaf sheaths; leaves narrowly oblong, scaberulent, the blades 2.5-7 cm. long, 1-2-pinnate, with 5-7 remote pairs of segments, the leaflets oblong-lanceolate, 2-4 mm. long, 1-1.5 mm. broad, crowded, apiculate, the petioles 1.5-4.5 cm. long, shortly sheathing below; . . . umbels 4-6-rayed, the fruiting rays unequal, 1-3 cm. long, ascending; . . . fruit oblong, 8-10 mm. long, about 6 mm.

Fig. 1. Slope immediately below Coal Mine Point, Black Ridge, Mesa County, Colorado (type locality of *Papilio indra minori*). *Lomatium eastwoodae* plants grow mainly at the base of ledges or boulders, with occasional plants being found beneath junipers and pinyon pines. Several *Lomatium* plants are located above

the net and in front of the boulder at the right side of the photograph, but their size makes them difficult to see from more than a few feet away.

Fig. 2. View of the eastern end of Black Ridge. *Lomatium eastwoodae* plants were generally distributed across the open rocky slopes.

broad . . ." (Mathias, 1938). The umbellets are 2-15-flowered and the flower color is believed to be yellow. (Only dried flowering specimens were examined by Mathias, and only fruiting plants were observed by the present authors.) From our observations of the various fruiting stages that the plants were in at mid June, it would seem that flowering probably occurs from April to early May.

HABITAT: The small, grayish-green plants were located among the rocks on the north side of Coal Mine Point, where the mesa walls begin to drop precipitously toward the canyons bordering the Colorado River in Fruita Valley (Figure 1). After about 20 minutes of searching on June 16, one of us (T. C. E.) found the first larva, a fully mature one resting in a rocky crevice between boulders near a *Lomatium* plant. Two more larvae were found that afternoon, both fourth instar and both on *Lomatium* leaves. The next day was spent at the eastern end of Black Ridge, on the border of Colorado National Monument, where a number of *Lomatium eastwoodae* plants were located on a south-easterly-facing slope (Figure 2). An intensive search yielded two larvae, one in third instar and the other in fourth instar.

Along Black Ridge, as will be noted in the figures, the habitat is arid, with open Pinyon Pine and Utah Juniper forest extending up the rocky slopes of the ridge from the canyons below and also covering the mesa tops. Interspersed among the low trees are such shrubs as sagebrush (*Artemisia*) and Mountain Mahogany (*Cercocarpus*), with *Yucca*, *Senecio*, and other wildflowers scattered along the slopes and washes. The elevation along the top of Black Ridge (from the eastern end to Coal Mine Point) is about 7,000 feet above sea level.

Further trips to the Colorado National Monument area on July 1-4, July 12-14, and July 20-21 did not produce more larvae of *P. i. minori*; indeed, even on the first of July most of the *Lomatium eastwoodae* plants were dried up and shriveled. Thus it seems probable that *P. indra minori* is single-brooded like *P. indra indra* in the Sierra Nevada (Emmel & Emmel, 1962) and *P. indra fordi* in the Mojave Desert mountain ranges (J. F. Emmel, unpublished).

The five *P. i. minori* larvae collected in June were reared at the Rocky Mountain Biological Laboratory, Gothic, Colorado, on intact *Lomatium eastwoodae* plants. Although all larvae reached maturity, only two pupated successfully. In the three that died while pupating, no parasites or evidence of disease were noted.

LARVAL HABITS AND POSSIBLE MIMICRY BY A MOTH LARVA

Feeding habits in the laboratory differed among the instars. The third instar larva remained on the leaf of the *Lomatium* plant, near the tip. The fourth instar larvae rested always on the petioles near the base of

the plant, moving to the outer edges of the leaves to feed. When disturbed, the third and fourth instar larvae immediately dropped off the plant. The fifth instar larvae, when not feeding, crawled up the sides of the netting bag suspended over the potted food plant, and remained motionless there. The larvae fed both during the daylight hours and at night.

On June 16, a geometrid larva was also taken on *Lomatium eastwoodae* at Coal Mine Point. Its pattern of coloration was superficially similar to that of a mature *P. i. minori* larva, and at first sight it was mistaken for this. Its length was about 40 mm. at maturity; its width was only about 6 mm. This coincidence of parallel color pattern may involve a case of Müllerian mimicry, where both insects are using a common conspicuous pattern of (warning?) coloration in the larval stage.

Description of Early Stages

Egg

The egg is identical in shape and coloration to the egg of *P. indra fordi,* while being slightly larger in size (about 1.1 mm.). The surface texture is smooth, and the color is cream when first laid. The drawing in Figure 3 is of one of the infertile eggs mentioned in the text above.

The one female observed in captivity laid her eggs singly, near the tips of the *Tauschia arguta* leaves.

Third Instar Larva

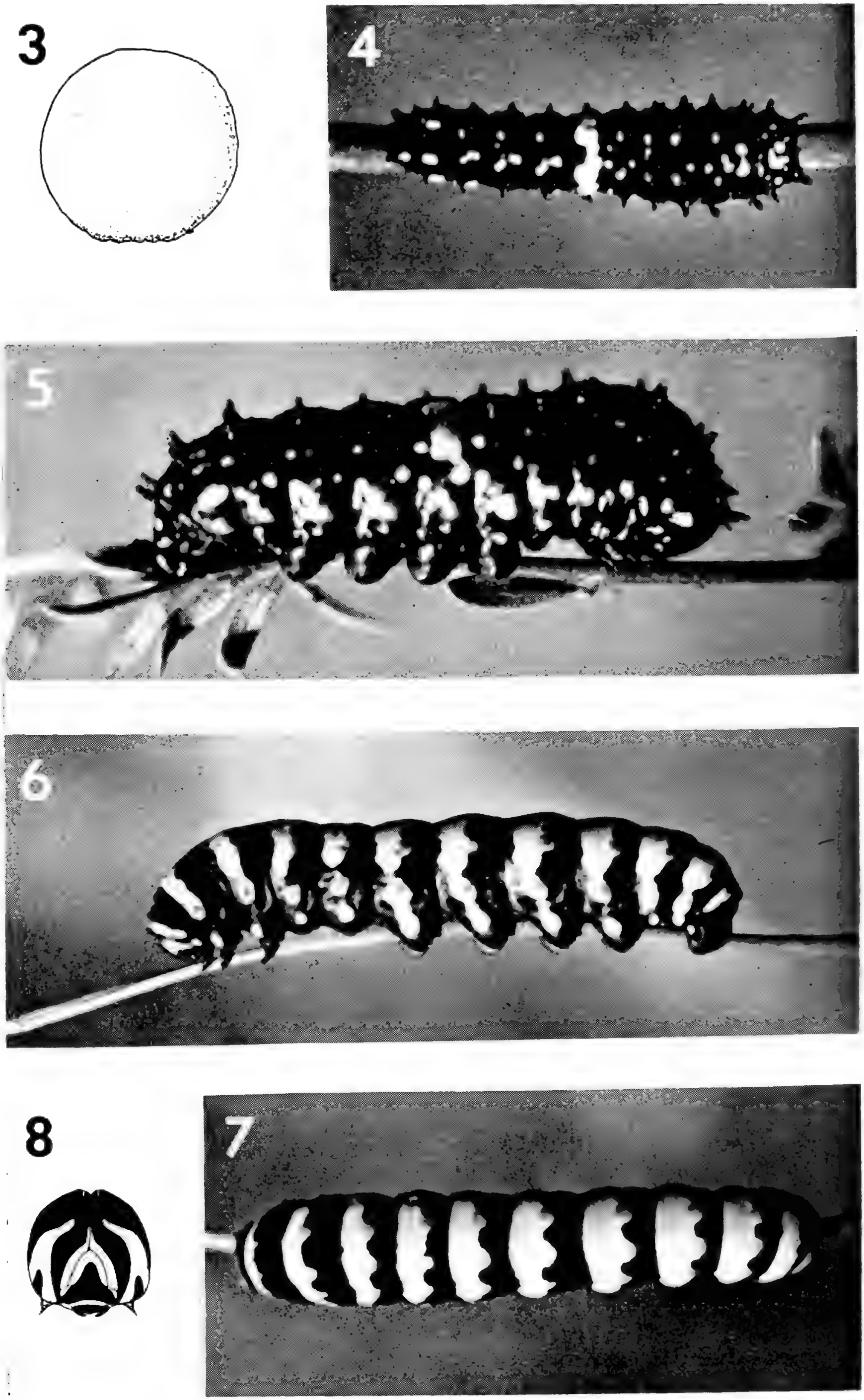
A dorsal view of the third instar larva is shown in Figure 4. The length of this larva at maturity was about 10 mm.; its coloration and pattern did not differ noticeably from those of the fourth instar larvae (see following description).

Fourth Instar Larva

Length: 17 mm. at maturity.

Head: Jet black, with an inverted crescent-shaped mark of light orange at the center and four white dots arranged across the upper margins (one pair on each side).

Body: Ground color black, with a blue sheen in strong side lighting (lateral view in Fig. 5). There are four anterior-posterior rows of black, pointed tubercles. The tubercles in the two dorsally-situated rows have orange spots located just medially to their bases. The tubercles in the two lateral rows have orange or white spots located just dorsally to their bases, and are about one-half the length of the dorsal tubercles. The white "saddle" mark on the seventh abdominal segment is irregularly shaped but is continuous in contrast to the "row of large oval white spots, transversely circling the body at about the seventh segment" on the fourth-instar *P. indra fordi* larva (Comstock & Martin, 1955: p. 148).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This "saddle" mark and the following marks varied slightly among the four *P. i. minori* larvae of this instar that we were able to observe. There is a lateral row of eleven light-orange spots immediately below the lateral row of tubercles, extending from the first segment to the caudal end. An irregular pattern of small white marks occurs along the lateral row of tubercles, and transversely around the last three body segments. A white spot occurs on the lateral side of the base of each thoracic leg; the thoracic legs and prolegs are black.

FIFTH INSTAR LARVA

Length: 37 to 40 mm. at maturity. Greatest width: 8.0 mm.

Head: 4 mm. in width. Jet black in color. An inverted "V" of red-orange occurs on the adfrontal margins (see Figure 8 for pattern).

Body: See Figures 6 and 7. Ground color, deep black. The first segment is edged anteriorly with a narrow band of pink (ending on each side at an orange spot), and has a broad band of black posteriorly. Each of the remaining segments has a wide, anterior, pink band arching over the dorsal surface. These bands end above (on segments 4-6) or surrounding (on segments 1-3, 7-11) the large lateral spot of orange found on each segment. The posterior margins of the pink bands curve caudally a short distance at four locations to surround an orange dot. These orange dots (dorsal to the large lateral dot) occur in four longitudinal rows: one on each side of the dorsal area, and one placed suprastigmatally on each side. The true legs and prolegs are black, with a large white dot occurring on their sides. The segments without legs likewise bear this single subventral white spot. The crochets are translucent gray, and the spiracles are black.

DISCUSSION: A later paper will present a comparative analysis of the biology of all the subspecies of *Papilio indra*. However, as the early stages of *P. i. minori* seem to be closest to those of *P. i. fordi* in the *Papilio indra* group, we may compare these briefly. The general light and dark pattern of the larval body is nearly identical to that of the mature larva of *P. indra fordi*, as described by Comstock and Martin (1955). The details of the coloration differ, however. The deep black areas on the *P. i. minori* larva never have the occasional blue sheen of *P. i. fordi* larvae. The light bands arching dorsally over the body segments are a

Fig. 3. Egg of *Papilio indra minori.* Actual diameter about 1.1 mm. Lateral aspect.

Fig. 4. Third instar larva of *P. indra minori,* dorsal aspect.

Fig. 5. Fourth instar larva of *P. indra minori,* lateral aspect. Note detail of *Lomatium eastwoodae* leaf.

Fig. 6. Fifth (last) instar larva of *P. indra minori,* lateral aspect.

Fig. 7. Same fifth instar larva of *P. indra minori* as in Fig. 6, but dorsal aspect.

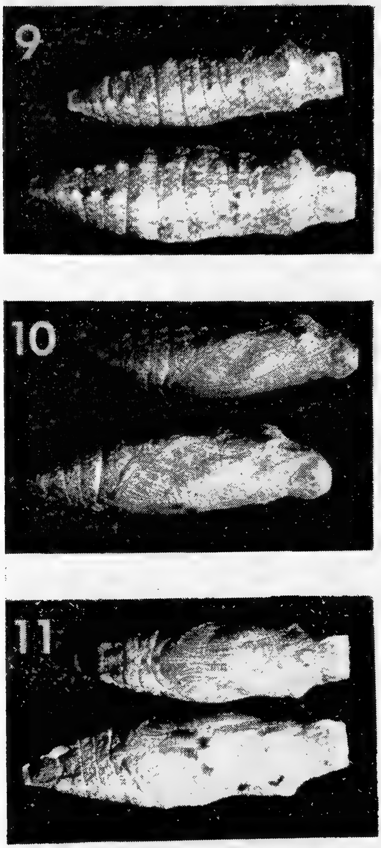
Fig. 8. Detail of the head of the fifth instar larva of *P. indra minori.* Dark areas black, light areas a red-orange, in this frontal view.

delicate PINK, rather than white or bluish-white as in *fordi.* The large dots on these bands are the same size as those found on *fordi,* but the color is a deep orange rather than lemon yellow. All other spots on the body are light pink in color or, occasionally, white, rather than yellow as on *P. i. fordi* larvae. As with *P. i. fordi* and *P. i. pergamus* larvae, the width of the black bands on the body segments varies between individual larvae.

PUPA

Male: Length, 20.9 mm. Greatest width at wing cases, 6.0 mm.

Female: Length, 24.5 mm. Greatest width at wing cases, 7.0 mm. (Figures 9, 10, 11).



Figs. 9, 10, 11. Pupa of *P. indra minori.* Dorsal, lateral, and ventral aspects, respectively. The smaller male pupa is shown above the female pupa in each figure.

Fig. 12. The food plant of *Papilio indra minori*: *Lomatium eastwoodae* (Coult. & Rose) Macbr. The leaves, umbel, and fruit are shown growing from the sub-woody caudex covered with old leaf sheaths.

The pupa of *P. indra minori* is nearly identical to the pupa of *P. indra fordi* (illustrated in Comstock & Martin, 1955). The ground color is a grayish tan, with short light and dark streaks giving all surfaces except the wing cases a lightly mottled appearance. The wing cases are predominantly olive-tan. The surface is rough with a profusion of tiny raised points and small wart-like nodules. There are two longitudinal rows of papillae extending posteriorly from the thoracic region: one row on each side of the dorsal area, and a second row placed suprastigmatally. These papillae are not lightly colored and conspicuous, as opposed to those on the pupa of *P. indra fordi.*

ACKNOWLEDGEMENTS

The present paper is part of a continuing study of species of the *Papilio machaon* complex in western North America. The aid of the Gordon F. Ferris Memorial Scholarship (to J. F. E.) from Stanford University is gratefully acknowledged.

Mr. Will C. Minor of Fruita, Colorado, was exceedingly helpful during our visit to the Black Ridge area. Superintendent F. G. Bussey and Naturalist Clarence J. McCoy of the National Park Service were most helpful in granting us a collecting permit to collect within Colorado National Monument and in answering our many questions about the area and its butterfly fauna. Mr. Donald Eff of Boulder, Colorado, very kindly supplied us with a living female of *P. indra minori* and detailed information on the type locality. Dr. Paul R. Ehrlich, Division of Systematic Biology, Stanford University, reviewed the manuscript and offered helpful assistance at the Rocky Mountain Biological Laboratory.

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ATTRACTION OF BUTTERFLIES TO LIGHT

by D. G. SEVASTOPULO

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With reference to Mr. Donohue's note (*Journ. lepid. soc.* 16: 131-132; 1962), the paucity of Indian records of butterflies attracted to light can, I think, be explained partly by the fact that the older generation of entomologists saw nothing remarkable in the occasional visit of a

butterfly to light; after all many other day-flying, sun-loving insects are so attracted, for example dragonflies, cicadas, grasshoppers, both long and short horned, plant bugs, bees, wasps, day-flying moths, etc., and partly because it is only comparatively recently that electric light has been extended to cover the smaller places.

I have published no records of butterflies attracted to light in India, but the crepuscular *Melanitis leda* L. and *Gangara thyrsis* F. were both fairly frequent visitors. In Calcutta, the satyrid *Elymnias hypermnestra undularis* Drury and the hesperiid *Suastus gremius* F., both of whose larvae feed on palms growing in verandahs, also appeared not infrequently.

In 1948, near Pantellaria Island in the Mediterranean, my ship passed through a migration of *Vanessa cardui* L., and a number of them were attracted to the ship's lights that evening (*Entomologist* 81: 186; 1948).

Working a mercury vapour lamp in East Africa has provided a very large number of records, some of which have been published in 1955 and 1958 (*Entomologist* 88: 37; 91: 86), and I give below a full list of the species that have been attracted. Some of these have been published previously and some have not. For the sake of completeness I have added the names of some day-flying moths that have also been attracted.

Papilionidae: *Papilio demodocus* Esp.

Pieridae: *Glycesthes creona severina* Stol; *G. c. infida* Btlr.; *Catopsilia florella* F.

Danaidae: *Danaus chrysippus* L.

Acraeidae: *Acraea encedon* L.; *A. eponina* Cr.

Nymphalidae: *Charaxes candiope Godt.; Hypolimnas misippus* L.; *Precis sophia* F.; *P. clelia* Cr; *P. lintingensis cebrene* Trim.; *P. orithya madagascariensis* Guér.; *Vanessa cardui* L.; *Crenis trimeni* Auriv.

Satyridae: *Melanitis leda africana* Fruhs.; *Gnophodes parmeno diversa* Btlr.; *Mycalesis safitza* Hew.

Libytheidae: *Libythea labdaca* Westw.

Lycaenidae: *Lachnocnema durbani* Trim.; *Hypolycaena pachalica* Btlr.; *Syntarucus telicanus* Lang; *Zizula hylax* F. (=*Zizeeria gaika* Trim.)

Hesperiidae: *Coeliades sejuncta* Vuill.; *C. anchises* Gerst.; *Chondrolepis niveicornis* Plötz; *Zophopetes cerymica* Hew.; *Pelopidas borbonica* Bsd.

Sphingidae: *Cephonodes hylas virescens* Wllgr.; *Leucostrophus hirundo* Gerst.

Noctuidae (Catocalinae): *Egybolis vaillantina* Stoll.

A NEW SPECIES OF *APODEMIA* FROM TEXAS (RIODINIDAE)

by H. A. FREEMAN

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On August 3, 1962 while examining some *Agave scabra* plants in the Chisos Mountains, Texas, looking for trap doors of *Agathymus chisosensis* (Freeman), my attention was drawn to a small Metal-mark that settled on the ground near my feet. After catching the specimen I quickly noted that it was unlike any that I had previously seen; thus, the rest of the afternoon was spent in looking for more specimens. I caught two more after about four hours' careful collecting. Later when I had taken the time to examine specimens of all the other North American *Apodemia* I decided that these three specimens were examples of an undescribed species of that genus, the description of which follows.

APODEMIA CHISOSENSIS Freeman, NEW SPECIES

MALE. Upper side: Primaries light coppery brown, being darker along costal margin, outer margin, and near base; seven black spots along outer margin; five black dashes present in submarginal area; two subapical white spots, the first merely a short line, the second broadly triangular; an irregular band of black spots in postmedian area running from just inside subapical spots to nearly center of inner margin; a black bar at end of cell with four small dots between this and base; wing shape normal and not strongly produced at apex; fringes black with three white spots present, one at apex, one near middle of outer margin, and one near tornus. Secondaries light coppery brown, being slightly darker along outer and anal margins; seven black spots along outer margin; eight black dashes forming an even curve throughout limbal area; five broad black dashes in discal area forming a straight line from inside outer angle to about midway of anal margin; two black bars near costa; a black bar at end of cell, with four black spots near base; fringes black with a white streak at outer angle, one white spot midway of outer margin, and another near anal angle.

Under side: Primaries similar to above except lighter and the apical area sordid white. Secondaries snow white with all spots reappearing very distrinctly; three orange spots between marginal spots and submarginal dashes, forming an even curve in limbal area.

Expanse 27 mm.

FEMALE. Upper side: Very similar to ♂ except for slightly broader wings and lighter ground color. The most distinguishing difference is macular band, which originates beneath subapical spots and goes to inner margin, composed of six sordid white, broad, spots. Secondaries are like ♂ except ground color is slightly lighter; all spots the same.

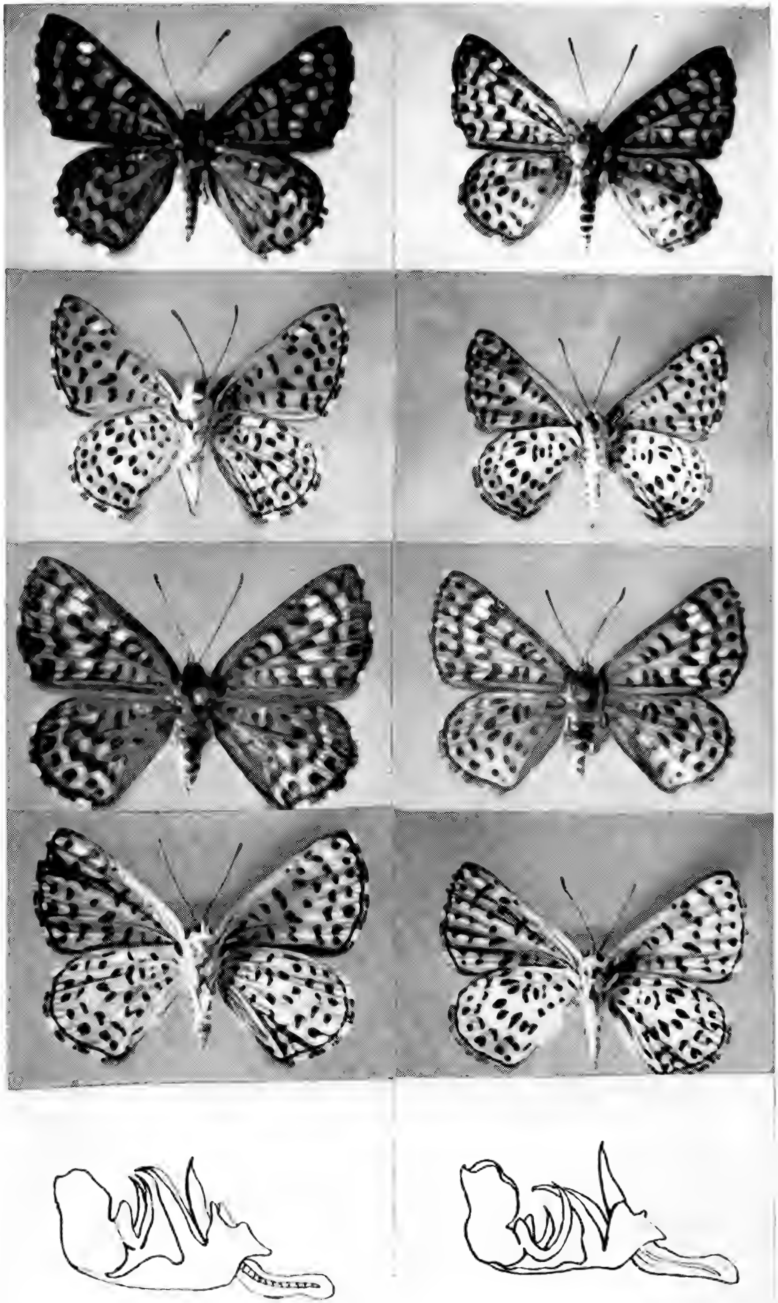
Under side: Primaries same as ♂ except ground color lighter; secondaries same as ♂ except slightly lighter.

Expanse 32 mm.

Thorax above dark grayish brown, beneath snow white; abdomen of same general color as thorax, with the segments marked by a white line; legs sordid white; palpus white; antenna black, minutely ringed with white.

The ♂ genitalia are illustrated on the plate.

HOLOTYPE, male, Chisos Mountains, elevation 5400 ft., Texas, 3 August 1962 (leg. H. A. Freeman); ALLOTYPE, female, same location, collector, and date. One ♂ paratype with the same data. The Holotype



Left column: *Apodemia nais* (♂ & ♀; White Mts., Ariz.; 3-4 July 1951). Right column: *Apodemia chisosensis* (Holotype ♂ & Allotype ♀; Chisos Mts., Texas; 3 Aug. 1962). Top row ♂♂, upperside; 2nd row, ♂♂ underside; 3rd row, ♀♀ upperside; 4th row, ♀♀ underside; bottom row, ♂ genitalia.

and Allotype are in the collection of H. A. Freeman. The paratype has been placed in the Stallings and Turner collection at Caldwell, Kansas.

The nearest relative of the new species is *Apodemia nais* Edwards; however, there are several ways that the two species can readily be separated. The genitalia are different, as the illustrations on the plate show. The ground color of the secondaries beneath is a quick way to separate the two species; since *chisosensis* is snow-white in both fresh and worn specimens, it can be told at once from *nais*, as that species has the ground color of the secondaries on the under surface soft gray with some conspicuous patches of pale copper around the end of the cell, and there is also a distinct coppery orange band between the spots and dashes in the limbal area. The most distinguishing difference between the two species is the alignment of spots in the discal area of the secondaries, for in *chisosensis* there are five well-defined, broad dashes forming a straight line, while in *nais* these spots are more rounded and the middle one is displaced inward towards the base. In *nais* the fringes are also checkered throughout, while in *chisosensis* there are only three white spots on each wing. The apex of *nais* is more pointed in the ♂♂ than is that area in *chisosensis*.

I wish to express my thanks to the National Science Foundation for research grant GB-398, making it possible for me to carry on research on the Lepidoptera, primarily with the Megathymidae.

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FURTHER ADDITIONS TO THE RHOPALOCERA OF AFGHANISTAN

by COLIN W. WYATT

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In this *Journal* (vol.15: 1-18; 1961) I described various "Additions to the Rhopalocera of Afghanistan with descriptions of new species and subspecies". In 1963 I returned there in the company of my friend Mr. Keiichi Omoto; the results of our expedition will be published later. Meanwhile, I give below the descriptions of the hitherto unknown ♀♀ of two subspecies described by me in the article mentioned above:—

Papilio alexanor hazarajatica Wyatt

Neallotype ♀: Panjao, W. Koh-i-Baba Mts., 10,000 ft., 26 June 1963. Markings exactly as in ♂, ground color slightly paler, and size very slightly larger.

Karanasa pamira kotandari Wyatt

Neallotype ♀: Kotandar Pass, Paghman Mts., Kabul, 11,500 ft., 25 August 1963. General markings and size as in ♂. Disc of forewing suffused with bright chestnut-brown into outer half of cell, and almost to base below cell. Vestigial traces of median band in slightly deeper tone of chestnut. Apical ocelli only present, as in ♂, but this may not always be the case; in the closely allied race *haslundi* Cl. & Sh. the ♀ usually, but not always, has two ocelli as is normal in this genus. Ocelli slightly smaller than in ♂, white pupilled. Chestnut color very slightly paler in the two internural spaces between ocellus and cell, and around the ocellus, but NOT a definitely different paler color as in *K. p. haslundi.* Underside as in ♂; forewing entirely suffused with chestnut, to base. Hindwing ground color a duller brown, not so blackish as in ♂.

A WEATHER-RESISTANT LIGHT TRAP FOR THE COLLECTION OF LEPIDOPTERA

by I. F. B. Common and M. S. Upton

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During the warmer months of the year, light-trapping of Lepidoptera in Australia often yields specimens of indifferent quality, owing to the damage caused by scarabaeid beetles and other hard-bodied insects. To overcome this problem and to collect especially the smaller slow-flying Lepidoptera, Common (1959) designed a transparent light trap for field use. Portable traps of this design are giving very satisfactory results. However, the plastics used for the construction of this trap gradually deteriorate if exposed for long periods to sunlight, making it unsatisfactory as a fixed trap for the continuous sampling of the fauna in any one situation. A light trap has therefore been designed to incorporate the useful features of the transparent trap, and yet be resistant to strong sunlight and other weathering agents. This trap has now been in use at Canberra for about three years and has yielded catches of consistently high quality.

Two features of the transparent light trap were shown to be of special significance. First, the whole area surrounding the trap was illuminated, resulting in the exclusion of a large proportion of the scarabs which were attracted to the light source. The catches of Microlepidoptera were also slightly, although not significantly, increased. Second, most of the scarabs which entered the trap were segregated from most of the remainder of the catch, greatly reducing physical damage to the Lepidoptera. To retain these features the fixed trap has been set in a cylindrical pit so that the light source is slightly above ground level, while the funnel beneath the light source leads to a cylindrical celluloid killing chamber incorporating two sorting devices similar to that used in the transparent trap.

Description of the Fixed Trap

The trap (Fig. 1) is established on a fairly elevated site with a gentle slope, about 30 yards from a gully. A concrete-lined pit (A), 3½ feet in depth and 2 feet in diameter is set in the centre of a low mound about 28 feet in diameter and about 1½ feet in elevation. The pit is surrounded at ground level by a 9 inch strip of concrete (B). The trap (Fig. 1) is lowered into the pit so that the centre of the 250 watt high pressure mercury vapour discharge lamp (C), used as the light source, is about 3 inches above the slope of the mound. The upper edge of the stainless steel funnel (D), beneath the lamp, is supported by a broad truncated cone of stainless steel (E), ending in a ½ inch vertical rim (F), which rests on the concrete surrounding the pit top (B). Radiating from the

lamp above the funnel are four vertical stainless steel vanes (G), and above these a convex glass window pane (H), two feet in diameter, is supported by four vertical rods to protect the lamp and the trap from rain. Any rain which does enter the trap during windy periods is drained through the centre of the killing chamber (J) to the bottom of the pit and thence out through an agricultural drain to the nearby gully. Three legs (I) are fixed beneath the funnel so that the trap, when removed from the pit, can be stood upright. They also act as guides when lowering the trap into the pit.

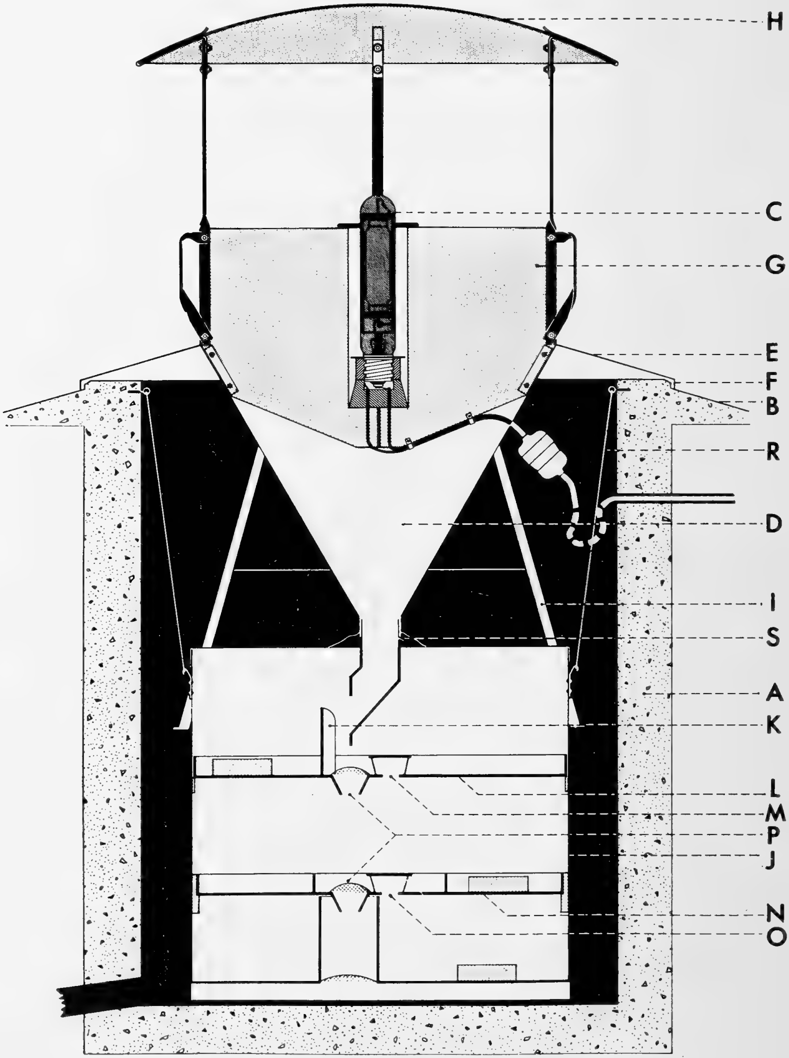

Fig. 1. Vertical section of the fixed light trap.

The cylindrical killing chamber (J) (Fig. 2), 18 inches in diameter and 18 inches deep, is made of celluloid with a close-fitting lid, through which passes the lower opening of the funnel (D). This opening is arranged so that all insects reaching the chamber from the funnel are directed against a vertical baffle (K) to the central section of the upper tray (L). The actively flying insects disperse in this portion of the chamber and most die in the outer sections of the tray. The scarabs crawl around within the central section and drop down through one of two holes (M), about ⅞ inch in diameter, on to two inwardly sloping baffles and thence to the central section of the tray beneath (N). Here the procedure is repeated, those actively flying insects which have fortuitously entered the second portion of the chamber tending to die in the outer sections of the second tray (N), while the scarabs once again find their way through similar holes (O) in the central section to the lowest portion of the chamber. Thus most of the scarabs accumulate in the lowest portion of the killing chamber, while the softer-bodied insects are distributed over the upper and middle trays. These trays are removed for sorting the catches. Near the centre of each tray, beneath the opening of the funnel, small convex areas of plastic gauze (P) allow rain water to pass through the two trays to a similar gauzed opening in the bottom of the killing chamber. A small tin with perforated lid (Q), as described by Robinson (1952), is used in each of the three sections of the killing chamber for the killing agent, tetrachloroethane.

In assembling the trap, the killing chamber is first suspended on wires (R) from three points within the pit. The trap funnel is then lowered gently into the pit so that its lower opening enters the top of the killing chamber, sealing itself with a rubber gasket (S). Centring of the trap in the pit is assisted by the three legs. The removal of the trap from the top of the pit is facilitated by two hand-grips attached to the outer edges of the vanes on each side of the lamp. The electric cable to the trap reaches the pit underground from a nearby power source. The removal of the killing chamber from the pit is effected by a three-hooked handle inserted in the suspension loops (T).

Discussion

As in the transparent trap, the design of this trap permits the whole of the area surrounding it to be illuminated. Scarab beetles which land on the ground near the transparent trap are prevented from entering by its smooth sloping sides. In the present fixed trap, a similar function is performed by the sloping sides of the truncated cone (E) and the vertical rim (F). Large numbers of scarabs collect and remain more or less immobile at the outer edge of this slope.

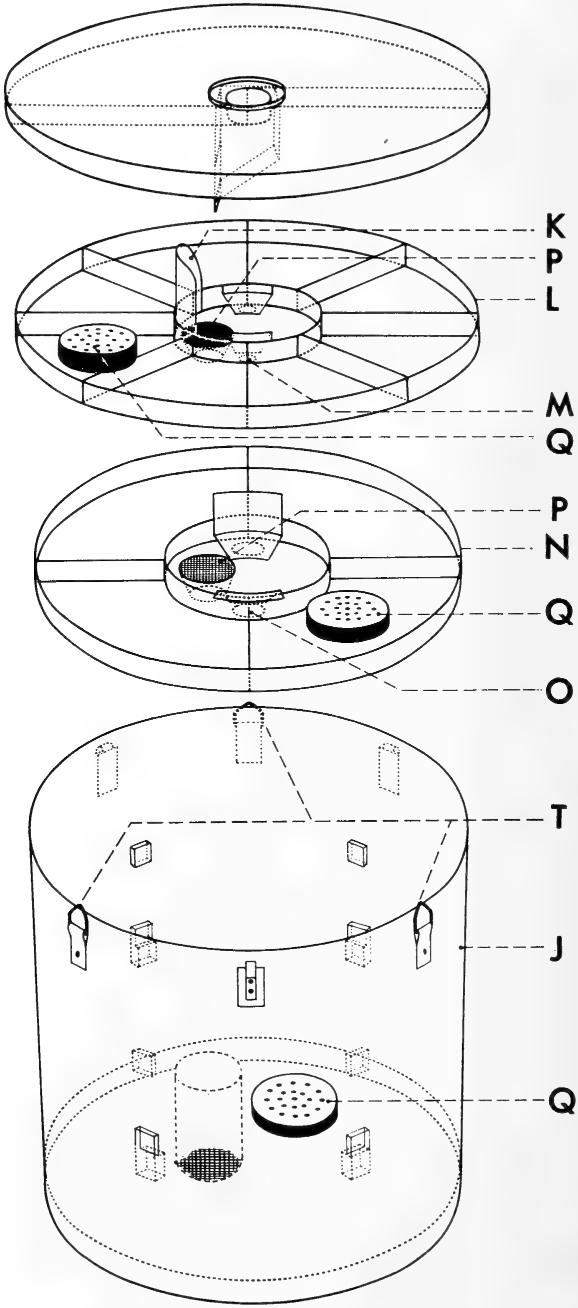

Fig. 2. Exploded view of the killing chamber of the fixed light trap.

The performance of a fixed trap cannot be compared quantitatively with other traps. However, there is little doubt that the Lepidoptera catches are comparable with those that might be expected in an opaque trap, using the same light source. The catches of Scarabaeidae have been consistently low, even in the middle of their flight periods and, as most are segregated from the catches of Lepidoptera, the quality of the latter has remained high. The size of the killing chamber and the ample floor area of the trays tend to prevent further damage to specimens which fly actively before death. An unexpected feature of this trap is that it collects a variety of terrestrial arthropods, including apterous and brachypterous insects, which are not normally taken in light traps. These include the first known specimens of certain brachypterous Oecophoridae, as well as caterpillars, centipedes, scorpions and spiders. Even small lizards have occasionally been taken.

Acknowledgements

Thanks are due to Mr. S. Jackson, who constructed the trap, and to Mr. L. A. Marchall who prepared the line drawings.

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A RANGE EXTENSION TO MISSOURI FOR *MONODES GEORGEI* (NOCTUIDAE)

During the first and second weeks of May 1962 I collected at black light a series of noctuid moths which were later identified as *Monodes georgei* Moore & Rawson by Dr. A. E. Brower. The range of this rather recently described species is given as Quebec, Nova Scotia and Livingstone Co. Michigan (Forbes, *Lepid. N. Y. and neighboring states,* part 3; 1954). Specimens were collected at several points through the Missouri Ozarks from Oseola in St. Clair County to Warsaw in Benton County. The species is an apparent native of the Ozark fauna as the flight time is a full month ahead of the northern population making a migration from that area impossible. These records extend the known range of *georgei* to the lower edge of the Upper Austral Zone. Whether the species exists as a relict form on the Ozark Plateau is an interesting question. To date I have been unable to learn of any records from the intervening area.

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R E V I E W

WIR BESTIMMEN SCHMETTERLINGE. PART II, *BAEREN, SPINNER, SCHWAERMER UND BOHRER DEUTSCHLANDS* (unter Ausschluss der Alpengebiete). By Manfred Koch. 148 pp., 24 col.pls. 1955. PART III, *EULEN DEUTSCHLANDS* (unter Ausschluss der Alpengebiete). By Manfred Koch. 291 pp., 24 col.pls. 1958. PART IV, *SPANNER DEUTSCHLANDS* (unter Ausschluss der Alpengebiete). By Manfred Koch (Sachbearbeiter der Eupithecien Eduard Schuetze, Kassel-Wilhelmshoehe). 263 pp., 20 col.pls. 1961. Publisher — Neumann Verlag, Radebeul & Berlin, Germany.

In volume 11 on p. 62, of this *Journal,* vol. I of Koch's *Wir bestimmen Schmetterlinge* was reviewed. In the meantime vols. II - IV, dealing with the bombycine moths, noctuids and geometrids respectively, have appeared. All the latest volumes are of the same high standard as was the first one with regard both to the text, which can be easily looked over at one glance, arranged in columns for locality, time of appearance of the caterpillar, flight period, foodplant of the caterpillar, frequency, remarks and typical characters, and to the natural color plates with pictures of all species concerned and most of their caterpillars. The arrangement of the pictures in a continuous way again gives an excellent account of relations among species, a fact which was already praised in the review of the first volume.

Besides the descriptive text, each volume provides a section with most valuable hints for the practical entomologist (part II: injurious Lepidoptera; rearing of bombycine moths; part III: collecting with the help of different light sources; part IV: collecting when travelling; migratory lepidoptera; genitalic dissection techniques).

The only thing one would have preferred to see changed is the unfortunate inclusion of some "micro" families, *e. g.* the Zygaenidae and Aegeriidae, in the bombycine moths (vol.II), where they positively have no place. But the same misplaced arrangement is found also in other European works of recent date, a sad tribute to the taste of the amateur collector over there. As the author points out himself, the somehow outdated nomenclatorial system has to be understood under the same aspect. Neither of the two objections, however, would considerably decrease the eminent value of the books for the student of Lepidoptera on this continent also, when taking into consideration their utmost practicality for getting quick information.

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OBSERVATIONS ON THE LIFE HISTORY OF *CALLOPHRYS XAMI* (LYCAENIDAE)

by J. BENJAMIN ZIEGLER and TARSICIO ESCALANTE
Summit, N. J., U.S.A. and Tacuba, D. F., MEX.

Callophrys xami (Reakirt) (=*Mitoura xami* auct.) is for the most part a Mexican species, occurring in that country in the Sierra Madre Occidental from Sonora state to Jalisco state, also in the Valley of Mexico, the Central States, the Valley of Tehuacan, the mountains of Vera Cruz, the Sierra Madre del Sur and Guerrero and Oaxaca states, always apparently in areas with a cool temperate to warm temperate climate. Since 1930, the species has been not rare in Mexico City itself, being the only Hairstreak which can be commonly encountered within the city limits. It ranges northward into the southwestern United States, having been recorded from southern Arizona and apparently now having become well established in southern Texas.

Although this species will probably not be encountered frequently by collectors north of the Mexican border, information concerning its biology should be useful as an aid in directing the search of those who have the opportunity to collect in areas where it might be found. Such information might perhaps also be of particular interest to students of the North American Hairstreaks in consequence of the bearing of such data on the systematics of this group.

A survey of the genitalia of both sexes of North American Hairstreaks, together with other considerations, has led to a proposed rearrangement and redefinition of the genera of this group (Ziegler, 1960). The demonstrated morphological gap between *C. xami* and the allied species placed in the subgenus *Mitoura* as restricted in that study had led us to suspect some ten years ago that a corresponding biological gap might also exist. This speculation received some support from the lack of records of probable association of *C. xami* with members of the family Cupressaceae, which are the known hosts of species of *C.* (*Mitoura*) (*s.s.*).

Continued observation of *C. xami* during the intervening years in and around Mexico City has now indeed confirmed this hypothesis and has led to the recognition of *Echeveria gibbiflora* De Candolle and *Sedum allantoides* Rose, both members of the family Crassulaceae, as hosts.

The family Crassulaceae comprises some 15-20 genera of succulent plants which are usually adapted to alpine, arid or otherwise inhospitable environments in various parts of the world. Some 6-7 of these genera occur in North America, with Mexico apparently forming a center of

distribution. Thus, Graf (1959) lists about 30 species of *Echeveria* and about 12 species of *Sedum* as occurring in Mexico. According to Hylander (1947), the genus *Echeveria* (Live Forevers) is confined to Mexico, southwestern United States and Central America. It forms a New World counterpart of the Old World genus *Sempervivum*, to which belong the House Leek and the Hen-and-Chickens which are commonly grown in home gardens as ornamentals. On the other hand, the genus *Sedum* (Stonecrops, Orpines) contains several hundred species which are native mostly to the colder temperate regions of the Northern Hemisphere. Many native species are found throughout the United States, particularly in the West and Southwest.

Most of what follows pertains in particular to conditions in the vicinity of Mexico City. It is to be anticipated that much of this information could be extrapolated to other parts of the range of *C. xami*.

During rearing studies on *C. xami* in New Jersey under laboratory conditions, attempts were made to feed the larvae with locally available ornamental members of the family Crassulaceae. It was found that the larvae would not accept Mossy Stonecrop (*Sedum* sp., probably *acre* L. or *mexicanum* Britton). On the other hand, they rather readily ate the common Hen and Chickens (*Sempervivum* sp.) in a fashion similar to that adopted with the true hosts, burrowing into the lower surface of a leaf near the base and proceeding to hollow out the leaf, leaving the exterior skin as a thin membrane. However, they did not survive on *Sempervivum* for more than a day or two, becoming rapidly immobilized and moribund before completing a molt.

IMMATURE STAGES

A. EGG

Generally similar in appearance to the ovum of other, related species of Hairstreaks. Roughly spherical as viewed from above, flattened laterally; about 0.7-0.8 mm. in diameter and about 0.5 mm. in height. The surface, except for the micropyle, covered with a prominent, raised network of perpendicular, flat-topped ridges, crisscrossing and mutually intersecting to form a close-packed array of irregularly-shaped cells, roughly circular to ovoid to polygonal; cell floors reflecting light with a frosted appearance. Each ridge with a central row of minute, closely-spaced dimples, parallel to sides. Ridges without raised prominences or bosses at intersections. This pattern of ridges and cells continued onto the depressed micropyle, but there reduced to a very low eminence, becoming obsolescent. Color pale green when newly-laid, becoming dull white with increasing age. Duration of stage in one individual – 7 days (September 24-October 1).

B. Larva

Scarcity of properly spaced specimens, food plant and time available for observations in the United States prevented determination of the exact number and duration of the larval instars. There are at least three, and more probably four or five. Descriptions of later instars are based on several specimens.

1. First Instar. Length approximately 0.8-1.0 mm.; ground color of body pale, dull yellow, no markings; body clothed with long, light brown hairs; head light brown; ocelli brown to black.

2. Intermediate (Penultimate?) Instar. Body color varying from chartreuse to dusky rose; when chartreuse, having a pair of mid-dorsal, longitudinal, parallel, narrow, rose-colored stripes; spiracles whitish or pale yellowish; otherwise similar to mature larva.

3. Last Instar. About 16 mm. in length; head pale, dull yellow, ocelli black; body often with pale, yellowish-chartreuse ground color; a series of rather large, mid-dorsal, rose-colored, trapezoidal (long axis at right angles to body axis) markings, each narrowing anteriorly, one per segment, becoming obsolescent toward anal extremity; on each side a lateral, sub-spiracular, bright rose-colored stripe, the two joining at the anal extremity; body coloring rather variable from specimen to specimen, one individual being almost entirely dull, old-rose in color, devoid of any but a few very ill-defined markings, another being entirely chartreuse in color without reddish markings; cervical shield ("bald patch") grayish yellow; spiracles black with light-colored rim; a mid-dorsal series of shallow depressions or pits, one per segment, rather nearer anterior edge of segment; entire body densely clothed with dark-colored hairs.

C. Pupa

Apparently rather variable in size, color and setal armature. One individual 11 mm. in length; uniformly very dark brown in color; verging on black, immaculate; spiracles light brown; almost naked except for a few sharp, brownish-black setae on dorso-anal region of abdomen and on dorsal, especially antero-dorsal region of thorax; two small, bilateral, closely spaced groups of shorter, light brown spines with flattened tips on ventro-anal region of abdomen. Another individual was 9 mm. in length; ground color of abdomen light, rather reddish brown, with dark brown blotches especially concentrated in dorsal region; thorax and wing cases dull tan, with a heavy overlay of brown blotches; spiracles not distinguishable from ground color; vestiture of setae sparsely but generally distributed over thorax and abdomen, somewhat more densely in dorsal region. Duration of pupal stage in a single individual 20 days under laboratory conditions.

HABITS AND BEHAVIOR

A. OVIPOSITION AND ACCESSORY ACTIVITIES. Under natural conditions, males were often seen perching on the apex of the tall flowering stalk of *Echeveria gibbiflora,* presumably waiting for a female to pass by. This was the species most often chosen by the female for oviposition. Having located a likely plant, the female laid her eggs singly, fluttering about the plant each time to find a good spot. Both sides of the leaf were utilized, but most often the underside, and usually very near the base. A single female has been observed to spend two entire days depositing eggs on a single plant, without once leaving the spot.

B. LARVAL FEEDING

On *Echeveria gibbiflora,* the larva burrowed completely into the leaf and fed on the fleshy pulp in the interior, during which time a honey-like liquid was seen to drip from the entrance hole. This liquid was relished by small, black ants which appeared to attend the larvae without harming them in any way. The larva was also observed to expel its feces through this same hole. Little by little the interior of the leaf was consumed until it was reduced to a thin-walled shell which turned yellowish, withered and fell to the ground beneath the plant. Not infrequently the large number of larvae harbored by a single plant completely destroyed their host.

On *Sedum allantoides,* with its smaller leaves, the mature larva was commonly observed with the anterior part of the body inside the sausage-shaped leaf and the posterior portion outside. When the larvae had completely devoured the leaves, they burrowed into the fleshy stem and continued feeding therein, finally converting the plant into a small trunk riddled with perforations which could no longer support life.

C. PUPATION AND EMERGENCE OF IMAGO

Under laboratory conditions, a mature larva was observed to take up its position on the under surface of a leaf among several on the floor of the rearing cage. It was seen to reverse its position by 180 degrees at least twice, apparently during the process of spinning a silken pad on the leaf. It finally attached itself to this pad by anal hooks posteriorly and by a silken girdle anteriorly, during the early evening of 20 September. It was unchanged on the evening of 22 September, but had completed its molt to the pupal stage by the morning of 23 September. The newly-formed pupa was quite translucent; the thoracic region was very pale straw-colored, with bright pink shades along the edges of the wing cases and also in the abdominal region. By early afternoon of the same day the color had darkened to its final brown hue. The imago, a female, emerged on 12 October.

Flight Period

The butterfly appears to have at least three broods. Our observations suggest the greatest abundance of adults near Mexico City during July to September, with another concentration during December to January and perhaps a third during April to May. Klots (1951) gives June and September-December in southern Texas, while Clench (1961) gives April, June-July and October-December in the same region. Roever (*fide* Thorne, 1963) reported fresh specimens taken in Arizona in early April, early July and early October. Actually, in view of the succulent nature of the host plants, it seems not unlikely that this butterfly might be on the wing more or less continuously in areas where the temperature permits.

Acknowledgements

We wish to express our great debt to Sr. Alberto Diaz Frances for important information leading to the recognition of the two host plants reported herein. We are grateful to the noted Mexican botanist, Prof. Maximino Martínez, for taxonomic determination of these plants, and to H. Avery Freeman and Donald Eff for other valued information.

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SYSSPHINX BICOLOR (SATURNIIDAE) IN ONTARIO

The southernmost part of Ontario, lying in the Austral Zone, has yielded over the years, with refined collecting methods, some surprising records, like *Lacosoma chiridota* Grote and *Cicinnus melsheimeri* Harris (Lacosomidae), *Apatelodes torrefacta* J. E. Smith and *angelica* Grote (Zanolidae), *Heteropacha rileyana* Harv. (Lasiocampidae), the Mississippi Valley subspecies of *Hemaris diffinis* Bdv. (Sphingidae), *Melalopha inclusa* Hbn., *Hyparpax aurora* J. E. Smith, and *Datana contracta* Wlk. (Notodontidae). Now it is possible to add to those the Citheroniine, *Syssphinx* (*Sphingicampa*) *bicolor* (Harris). The first known specimens are a male and a female, collected in June and July 1943 by Tom Norris in Brantford, Ont. They were detected in student collection material at McMaster University in Hamilton, Ont., by D. M. Wood in 1962 and

subsequently deposited with the Royal Ontario Museum in Toronto, Ont. Until this time it was thought that *bicolor* occured in Ontario only around Dunnville, Ont., very near the north shore of Lake Erie, where on May 31, 1957, three fresh male specimens were taken by R. Plath. In 1959 a female and in 1962 a male were taken by W. Plath Sr. It therefore can be supposed that this species is well established in the remnants of the deciduous forest around Dunnville.

The known range of *bicolor,* compiled from the collections of the American Museum of Natural History, the Canadian National Collection, and the Carnegie Museum, Chicago Natural History Museum, Michigan State University Museum, and the Royal Ontario Museum, as well as from Packard's *Monograph,* appears to be: Arizona, Arkansas, Illinois, Iowa, Kansas, Kentucky, Mississippi Valley, Missouri, Nebraska, New Jersey (a single specimen on the coast), North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, Texas, Utah, Virginia.

In addition there are two interesting notes in print. 1) In *Lepidoptera of New York and neighboring states* (1923), W. T. M. Forbes records for *bicolor*: "New York: (Grote, presumably from Buffalo)." 2) In *An annotated list of the moths of Michigan exclusive of Tineoidea* (1955), Sherman Moore lists *bicolor* from Oakland, Washtenaw, and Wayne Counties, all on the southern peninsula of Michigan. As is to be seen, we have localities from where *bicolor* is recorded on the western end of the north shore of Lake Erie as well as on the east end. With extreme S. W. Ontario in between, the occurence of *bicolor* in Ontario therefore is not surprising, even though overlooked over a quite long period. Buffalo is only 36 miles E. of Dunnville and 68 miles S. E. of Brantford, so that the two Ontario populations of *bicolor* seem to be an extension of the vaguely presumed and otherwise isolated Buffalo population.

The appearance of *bicolor* in extreme S. W. Ontario will be carefully watched in the years ahead; especially the Windsor area will be included in any survey (Rondeau Provincial Park).[1]

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[1]After this was written the Royal Ontario Museum received a fresh male, taken by Miss N. A. Scott, on July 8, 1962, in Woodbridge, 13 miles northwest of Toronto, on the very limits of the Upper Austral Zone in Ontario. Possibly the species is expanding its distribution. The question as to the foodplant is open. Perhaps we will find a parallel to *Eacles imperialis* Drury.

THE MAINTENANCE FOR EXPERIMENTAL PURPOSES OF FORM "SULPHUREA" OF *PIERIS NAPI* (PIERIDAE)

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It may be guessed that when in 1909 Mr. H. W. Head (as he related 30 years later) received his "female specimen of *P. napi* of a pale yellow colour" from the teacher at Tullybeg School in Donegal, its primary importance to him was as a possible source of income; since he was a commercial breeder, he cannot be reproached for that. The bright yellow variety, previously almost unknown, that he ultimately bred from this Irish female, became known as "ab. 'citronea' Frohawk". It has given pleasure to European collectors ever since and for a long time this was the chief function that it fulfilled.

However, more recently this form, properly known as "sulphurea" Schöyen, has provided a means of attacking a number of problems, both those that are special to the *Pieris napi - bryoniae* group of butterflies and those of a more general character that can be studied in that group. Its merits for these purposes arise primarily from the certainty with which it can be determined, its simple recessive inheritance and its nevertheless robust constitution. A particular advantage is its genetic control from the locus which also governs the characteristic parti-coloured wild-type pattern of *napi* and related butterflies.

Experimental Uses of Form "sulphurea"

(1) It may seem obvious that experiments involving the breeding of any species will be carried out most conveniently where that species is native. This is far from being the case. Though the food-plant will certainly be available, and fresh stock can be obtained with little difficulty, in default of quite exceptional precautions there will always be some risk of waifs' entering the experimental stock with gathered food. In some cases this may vitiate the experiment or, if it is unsuspected, even lead to incorrect conclusions. If, however, the whole of the experimental material can be marked with a bisexual recessive variation, this risk is eliminated: if the stock is homozygous, the intruder is recognised when the adult emerges; if it must be heterozygous, the suspected intruder is detectable only by mating with the corresponding homozygote.

(2) Successful pairing of a homozygous recessive female with a like or an unlike male is demonstrated by raising her eggs to the imaginal state. This was the means of disproving a statement that a female *Pieris napi* would pair successfully only once, and of showing that after the second pairing the first became ineffective (Bowden, 1951). Even

the forced-pairing techniques of Lorkovič (1952) fall short of artificial insemination, but if the latter is ever applied to *Pieris* we may be sure that "sulphurea" will again prove useful.

(3) The present author has used it to supply a "visible" *napi* gene which could be traced in hybrids with *P. bryoniae* Ochsenheimer for many generations (Bowden, 1962). Although there are many barriers, unsuspected at first, between *napi* and *bryoniae*, it appears to be possible to backcross the hybrids indefinitely to *bryoniae*. As long as the presence of "sulphurea" can be demonstrated, it remains clear that *napi* has not been completely "bred out" by any automatic selective process.

(4) Petersen and Tenow (1954) described experiments in which they investigated the supposed sexual preference barriers between *Pieris napi* and *bryoniae*. They found, rather surprisingly, that *P. bryoniae* males were more attracted to *napi* females than to their own, the white colour being apparently the deciding factor. We do not presume to suggest what the result might have been, but we should have liked to see these experiments extended to include females of form "sulphurea".

(5) The question of selective pairing may arise, of course, within a species. It has importance as one of the mechanisms which may contribute to the maintenance of a polymorphism (Williamson, 1958). Pairing selection, if proved to exist, is difficult to interpret: it may be the result of differing visual stimulus, or it may depend on some apparently unrelated invisible character which has become correlated with the visible one. Assuming that the basis is visual, "sulphurea" would provide good experimental material.

(6) It is quite possibly true that, as long as good "resting" camouflage is retained, white colour is advantageous to *Pieris*. The disadvantage that we are inclined to associate with recessive inheritance probably lies, in the case of "sulphurea", in the extended yellow pigmentation. The breeder would judge that any invisible correlated disadvantage must be slight indeed. He might be of a very different opinion about the "albino" variety (with decolorized "black" markings) which turns up rather frequently in the Pieridae: here there may well be an accompanying weakness. Quasi-"natural" selection experiments using these two recessives and wild-type might give interesting results.

(7) A project that we have toyed with for some time is an attempt to detect "sulphurea" alleles in natural populations of *Pieris napi*. The heterozygotes of any rare recessive will be very much less rare than the visible homozygotes; it is the heterozygote therefore that we may hope to find. Though there are several "sulphurea" alleles (Bowden, 1961), Head's "citronea" is perhaps the ultimate recessive. Captive virgin females of this form, mated with wild males collected at random, would

show by their offspring if any of these "type" males was in fact the heterozygote of a "sulphurea" allele. A further generation would have to be bred only to characterize fully an allele already detected in this way. Although the best-known British "sulphurea" specimen came from Norfolk (Barrett, 1881), and Thompson's pale yellow had apparently a Flintshire origin, it is still the general opinion that Ireland would be the best place to search. Nevertheless, if "sulphurea" is maintained by recurrent mutation, it must surely exist (even if at very low frequency) in Asiatic and American subspecies.

(8) The dominant white-underside morph "subtalba" Schima which is maintained in balanced polymorphism in *Pieris bryoniae neobryoniae* Shelj. has proved to be very closely linked (if not indeed allelic) with the recessive "sulphurea" (Bowden, 1963). "Subtalba"-like forms which occur in such distinct subspecies or species as *dubiosa* Röber or *virginiensis* Edwards are probably also dominant, but there is no obvious way of determining experimentally whether the responsible genes are identical or homologous. However, successful hybridisation and back-crossing with *napi* f. "sulphurea" should allow a decision whether or not they are linked.

(9) *Pieris napi* provides exceptionally favourable material for the study of pterin pigments and their genetic control, apparently surpassing in this respect any species of *Colias*. The sex-limited ochre-yellow of the various *bryoniae* subspecies is from many points of view of outstanding interest; this is increased by its relation to the lemon-yellow and white pigments controlled by the "sulphurea"-"subtalba" alleles, some of which (but not all) operate independently of sex.

Breeding Form "sulphurea"

A few notes on the maintenance of stocks of this useful and attractive variety of *napi* may be of some assistance, in spite of their European bias. First, we offer some remarks which apply to any subspecies of *P. napi* or *bryoniae.*

The larvae may be reared by the usual techniques, which it is not necessary to describe in detail. They are less exacting than most species, and can sometimes even be raised successfully in the dark, with little ventilation, provided that paper or the like is supplied to absorb moisture. Crowding also seems to be harmless in itself, as long as it does not lead to excessive condensation, but of course if disease does appear congestion results in disaster. Pupating insects also may be more frequently disturbed by wandering larvae, and the chance of cannibalism is probably rather increased.

If it is intended to breed *napi* continuously, it is unsafe to rely entirely on wild food. In the late summer clean leaves in good condition may

not be plentiful on wild plants, just when stocks of larvae are at their highest. In England, the most satisfactory food to grow is Dame's Violet, *Hesperis matronalis* L.; it has the advantage, too, of possessing decorative, sweet-scented flowers. Very "sappy" leaves are best avoided, but the plant has a very long productive season, certainly well into December in normal years, and being cut down will spring up again. The flowering shoots have strong stems and as they last well in water can be put in the laying cages for eggs. Some individual females lay on the flower petals (which drop before the eggs hatch); if this is found to be happening, the flowers and flower-buds must be removed from the shoot for that female. Subject to this same contingency, the flowers when available are a good source of nectar for the caged butterflies. Eggs and larvae of wild *P. napi,* as well as occasional *Euchlöe cardamines* L., may be found on *H. matronalis;* it should therefore be searched before it is put in the breeding cage or used as fodder. More troublesome on *Hesperis* are microlepidoptera, particularly *Plutella porrectella* L. When an infestation is discovered, affected leaves should be destroyed and the plants sprayed twice with derris at a fairly high concentration. After thorough washing by rain or hosing with water, to remove insecticide residues, the plants are soon available again and usually remain free for some time.

The most useful wild plant is Jack-in-the-hedge, *Alliaria petiolata* Bieb., if it is to be found locally. It keeps for some days after picking, in a closed tin, without water. It is not always easy to detect waif larvae on the underside of *Alliaria* leaves; as well as looking over them carefully in the usual way, one should hold the leaves up to a strong light. In some districts *Alliaria* is absent or exceedingly scarce; in many such places, however, Lady's Smock, *Cardamine pratensis* L., can be found in quantity on marshy ground. *Cardamine hirsuta* L., growing by upland streams and elsewhere, is more difficult to obtain in quantity but is much favoured by the wild females for egg-laying. In the late summer Horseradish, *Armoracia rusticana* Gaertn., may be resorted to, but it does not keep well in water and it frequently bears larvae of *Pieris rapae* L., which are not easily seen and may perhaps carry disease. Shoots of Watercress, *Nasturtium officinale* R.Br., are sometimes useful but have so high a water-content that they are difficult to deal with in closed tims. "Shop" Watercress is often too stale. In the breeding cage a Watercress shoot attracts eggs well from laying females, but only too often proves to carry undetected eggs of the Mustard Beetle, *Phaedon armoraciae* L., whose black larvae proceed to destroy the leaves before the *napi* hatch. Many other Cruciferae are useful if leaves in good condition are available. In the depth of winter even Brussels Sprouts can be used to feed up a

late brood. We have not tried frozen-packed sprouts!

The over-wintering pupae of the *napi - bryoniae* group can be stored till the following October at 1°C, though deterioration is sometimes rapid after September. Cold storage makes the approximate synchronization of emergences a simple matter; moreover batches from the same brood can be withdrawn from cold at different times and used for different purposes. Very close synchronization of emergences is possible by a refinement of the cold-storage method, due to Petersen (*in litt.*, 1961). But once imaginal development in the pupa is well under way, a prolonged return to low temperature is not usually tolerated well, and crippling results; the males are usually the worse affected.

The butterflies pair readily in warm weather in net-sided outdoor cages of 6 cu. ft. or less; larger cages are not as successful. The roof of the cage, while transparent, must be capable of breaking the force of heavy rain; in England, a light wire-reinforced plastic material called Windolite seems most convenient. In cold weather, well illuminated cages indoors can be used with good results, but it is less troublesome to complete the desired pairings outdoors if possible. Again, although Lorkovič and others have used forced pairings among *Pieris*, such assistance seldom seems to be required within the *napi - bryoniae* group. Unless the cages are individually insect-proof, they should be placed on a wooden plat-

Fig. 1, Outdoor net-sided cages used for pairing *Pieris napi*.

form supported off the ground in such a way that earwigs and ants are excluded (Fig. 1). For years the writer has used four cast-concrete supports which he barbarously calls "isolegs": these are shaped like lidless boxes and have a central pillar, also of dense concrete, fixed in the centre of the bottom and projecting two inches above the rim. The space around the pillar, being kept full of water, acts as a defensive moat (it is also much visited by thirsty birds and bees). Since the arrangement raises the platform only eight inches off the ground, the grass must not be allowed to grow too long beneath it. It may be necessary to provide some protection from the curiosity of youthful cats.

The butterflies can certainly be fed from sugar-pads and other types of drinking-fountain. But these require regular attention; if it is doubtful whether this can always be given, it is safer to place in the cage jam-jars of fresh flowers in water. The choice of flowers is governed by what is available, but it is soon clear that some are useless, either because they contain no accessible nectar or because they droop quickly in water. It will probably be necessary to draw on both wild and cultivated flowers. Some of the very best are Dandelion (*Taraxacum officinale* agg.), *Crepis taraxacifolia* Thuill., Sweetwilliam, Lavender, Mint, Golden-rod and Michaelmas Daisy.

While eggs are appearing in the cage it is best to take them indoors every few days, so that the larvae on one leaf hatch more or less together. Eggs brought in usually begin to hatch about five days later.

BREEDING SYSTEMS FOR STOCK MAINTENANCE

Pieris napi seems to be sensitive to inbreeding. In consequence, the breeding procedure used for maintaining a recessive variety has to provide for frequent outcrossing. In general, a brood wholly homozygous for "sulphurea" should not be inbred further without initiating also an outcrossed line which can be taken up later if necessary. The simplest system is (Fig. 2):

(1) Outcross to wild-type: offspring will all be white.
(2) Inbreed these: one-quarter of offspring will be yellow.
(3) Pair these yellows and discard the whites: offspring will all be yellow.
(4) Outcross to wild-type, etc.

In the diagram *s* is the "sulphurea" gene, + is its wild-type allele. If each brood produces 100 butterflies, one rears 300 to obtain 125 yellows.

A rather more elaborate system, offering greater security, is (Fig. 3):

(1) Outcross twice to unrelated wild-type: two separate all-white broods will result.
(2) Inbreed these separately: one-quarter of offspring will be yellow.

(3) Pair (twice) a yellow butterfly from (2) with one from the non-parental white brood (1). (This is possible if, as usually happens, part of a brood emerges at once and part lies over the winter; it can also be done, using over-wintering pupae, by withdrawing them in separate batches from cold storage.) Half of offspring will be yellow in each brood.

(4) Pair yellows of one brood with yellows of the other: offspring will all be yellow.

(5) Outcross twice to wild-type, etc.

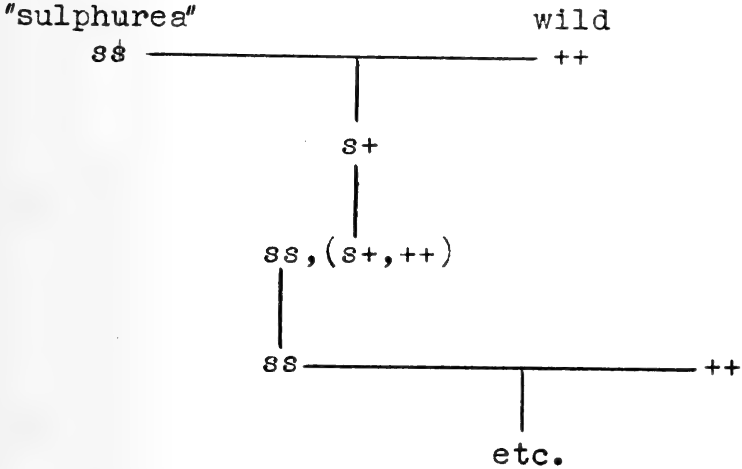

Fig. 2, Diagram of system for outcrossing "sulphurea" line.

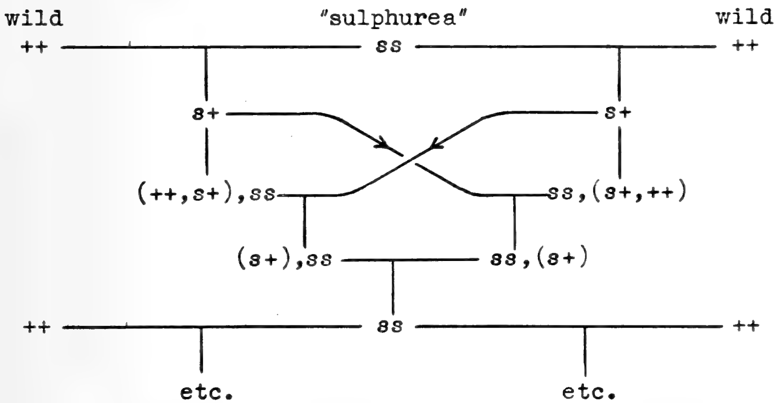

Fig. 3, Diagram showing more elaborate system for outcrissing "sulphurea" line.

If each brood produces 100 butterflies, one rears 700 to obtain 250 yellows. In practice, one reduces the size of those broods which cannot be expected to give yellows, and duplicates all-yellow broods when large numbers are required.

It is possible to maintain two recessive "sulphurea" alleles together, as easily as one, if the double heterozygote is acceptable as one of the forms. Writing "citronea" as $s^h s^h$ and Thompson's pale pellow as $s^p s^p$ and $s^p s^h$ (Bowden, 1961), the scheme is as in Fig. 4. If by mischance the initial pale yellow is $s^p s^p$, its pairing will produce no "citronea". All the offspring will be $s^p s^h$, which should then be paired with any available "citronea" and the system restarted. One then rears 300 to obtain 150 of the yellow forms.

Two unlinked recessive genes can be maintained together by a scheme such as that in Fig. 5. The yield here is 150 homozygous forms (including 50 double homozygotes) in 300 insects reared.

In breeding of this kind it is important to base the system on forms whose genotype can be identified with certainty. For example, the scheme shown in Fig. 4 would break down if the pale yellow, instead of the "citronea", were outcrossed to wild-type, since the offspring would then be a mixture of indistinguishable s^h+ and s^p+.

Finally, it must never be forgotten that, however careful one may be, some unforeseen disaster may destroy all one's stock of an insect. If the species is *napi,* one can do a great deal to guard against the risk, but that may not be sufficient. So it is wise to share stocks with others.

SUMMARY

Head's bright yellow variety of *Pieris napi* is not only beautiful, but also experimentally useful. It has been used in experiments on repeated pairing, as a "visible" *napi* gene in *bryoniae* hybrids, and as a means of excluding waifs. It might be used in investigations of selective pairing, both inter- and intra-specific. With the less robust "albino" form, it would be suitable for experiments on quasi-"natural" selection. It could be employed to detect the heterozygotes of other alleles at the "sulphurea" locus. Various *napi*-group butterflies which lack bright yellow on the underside can be investigated conveniently by hybridizing with f. "sulphurea." Finally, the various "sulphurea" allelomorphs provide favorable material for the study of genetic control of the pterin pigments.

Breeding follows the straightforward techniques applicable to all the green-veined white butterflies, but should be planned in such a way that a wholly homozygous brood is never inbred further, without also outcrossing to wild-type to provide subsequent generations. Two

"sulphurea" alleles can be maintained as easily as one, and two unlinked recessives are no more difficult, but in all cases the breeding system should be based on forms of identifiable genotype.

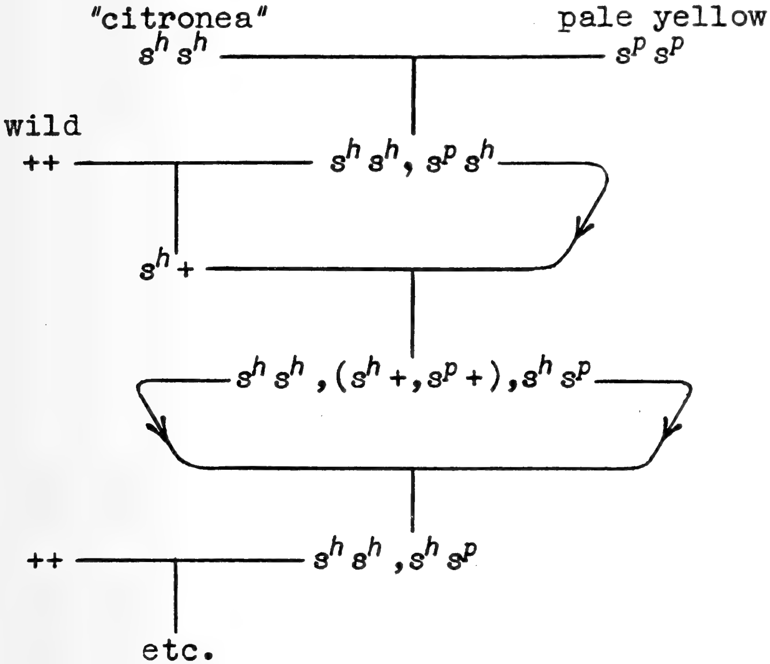

Fig. 4, Diagram showing system to maintain two recessive "sulphurea" alleles together.

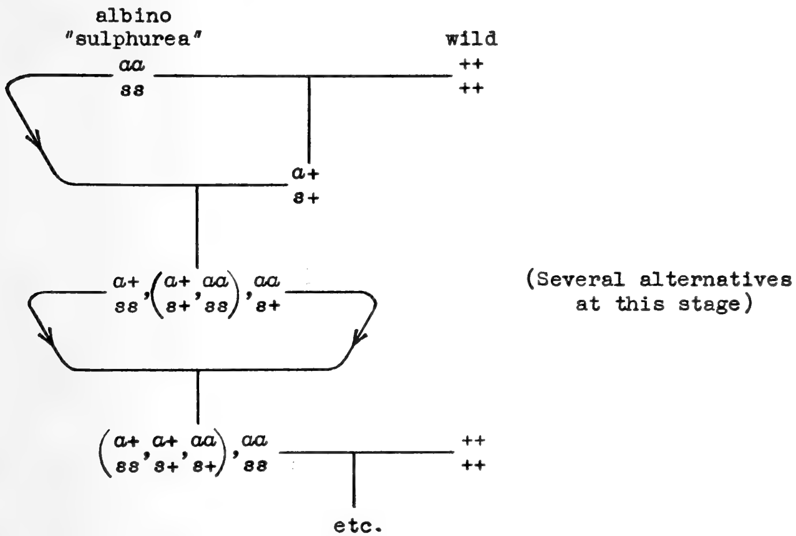

Fig. 5, Diagram showing scheme wherein two unlinked recessive genes can be maintained.

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE – NOTICE OF USE OF PLENARY POWERS

In accordance with a decision of the 13th International Congress of Zoology, 1948, public notice is hereby given of the possible use by the International Commission on Zoological Nomenclature of its plenary powers in connection with the following case, full details of which will be found in *Bulletin of Zoological Nomenclature,* Vol. 21, Part 1, published on 25 March 1964.

Designation of a type-species for *Hypercompe* Hübner, [1819] (Insecta, Lepidoptera). Z. N. (S.) 1611.

Any zoologist who wishes to comment on this case should do so in writing, and in duplicate, as soon as possible, and in any case before 25 September 1964. Each comment should bear the reference number of the case in question. Comments received early enough will be published in the *Bulletin of Zoological Nomenclature.* Those received too late for publication will, if received before 25 September 1964, be brought to the attention of the Commission at the time of commencement of voting.

All communications on the above subject should be addressed as follows:

The Secretary,
International Commission on Zoological Nomenclature,
c/o British Museum (Natural History),
Cromwell Road,
LONDON, S. W. 7, ENGLAND

W. E. CHINA
Acting Secretary to the International Commission on Zoological Nomenclature

AN UNUSUAL ABUNDANCE OF *AMATHUSIA PHIDIPPUS* (AMATHUSIIDAE) IN CEBU, PHILIPPINES

by JULIAN N. JUMALON

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Few are the hamlets and countrysides in the Philippines where *Amathusia phidippus* (Linné), a large brown butterfly, is not a familiar sight at twilight. Its hasty, jumpy flight, large size, and habit of gamboling if several are around, sets it apart from other crepuscular fliers such as species of the satyrid genus *Melanitis*. Likewise, one seldom comes across banana and coconut groves which do not have a colony of a form of *phidippus*. Cebu's subspecies is *Amathusia phidippus pollicaris* Fruh.

In past years, there was no recorded or reported instance of pronounced abundance of this butterfly, that is, inside of this somewhat limited area, although in February 1954 about twenty pupae were brought indoors by children for hatching, all taken at the area under treatment in this article. In respect to their crepuscular activity, and frequency of encounter with immature stages in recent years, no sign of abnormalcy was noted. The same is true with observations made in parts of western Leyte and the provinces of Agusan, Surigao, and Davao in Mindanao in 1960-62.

From the latter part of December 1961 to the latter part of March 1962, this twilight beauty has multiplied in numbers which to perennial observers is beyond normalcy. The area of infestation in the suburb of Cebu City is less than a square kilometer, and involves the districts of Labangon, Mambaling, and Punta Princesa. There is a possibility that adjacent areas where investigation was not extended, may have received a share of the infestation by the destructive larva of the butterfly.

When this was first observed and reported by a team of high school students headed by Osman, the writer's son, sometime in January 1962, the density of the population was already slightly above normal, but subsequent week-end visits to the place revealed a steady crescendo until the peak was reached somewhere between February and March. The increase in numbers especially of males was particularly noteworthy in an area bordering a small slightly watered creek profusely vegetated with a tangle of shrubbery, with a predominance of coconut and bananas, and a sprinkling of betel nut, citrus, and other fruit-trees. Larvae in various stages were noted on all the monocotyledons mentioned. On these visits pupae were collected for indoor hatching.

Banana groves left uncleaned by their owners provide good hiding places of imagines, since their tangle of dried leaves affords perfect camouflage background when the insect alights with folded wings in

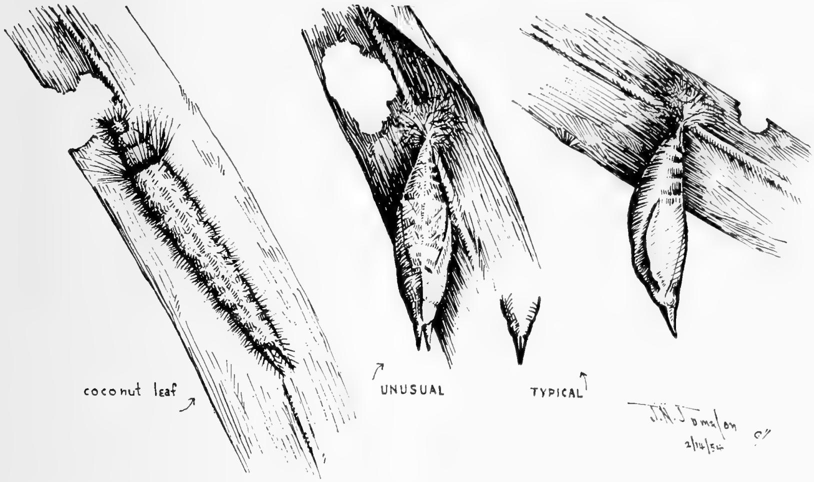
daylight. Here, by shaking these clusters of dried leaves, scores of sleepers are flushed out. Usually the insects do not fly far and long. They immediately settle on nearby hideouts, although as a rule most usually return to their favorite hideouts in due time, unless the disturbance is prolonged.

At the height of infestation it was easy for two or three boys to pick in few hours well over a hundred specimens. Visits were usually made in the morning at which time the flight of the disturbed sleepers is brief. At twilight, or close to twilight, when they become active, collecting becomes brisk, and the scores of flying dark forms offer good exercise to one's limbs and eyes. On about the last week of February, two boys took 68 fresh specimens in less than two hours in the later part of the morning, collecting at the same time live pupae for indoor hatching. Collecting imagines, however, was limited to those which alighted on low or young coconuts and bananas. Those which sought the tops of full-grown coconuts escaped molestation.

On going over the sexes, we found that the males outnumbered the females by five to one. There is considerable uniformity in the stripes and colors of males; on the other hand, the sub-apical light brown area on the dorsum of the females' wings, varies in size and intensity of shade although not to a marked degree. Attack by parasitic Diptera is about 25% on all pupae brought indoors. Those which emerged were perfect, beautiful specimens with only about 1% abnormality in one form or another. Also, out of about a hundred specimens, only one female and three males are undersized. (Of the 1954 batch, 90% were parasitized by 2 species of flies.)

All the recorded foodplants of this amathusiid form of Cebu are monocotyledons. They are: *Cocos nucifera* Linné (Coconut), *Areca catechu* Linné (Betel Nut), *Corypha elata* Roxb. (the Buri Palm - source of sago flour, basic food of Melanesia), *Nipa fruticans* (Nipa or Sasa Palm, widely used for thatch), and *Musa sapientum* (Banana). It is likely that other members of this division of angiosperms are also favored by the larva, especially at places where the above-mentioned are less abundant or absent. Individuals were found by our expeditions to Leyte and Mindanao on mountainous areas of not over 1,000 feet elevation; the only possible foodplants present were wild bananas, Abaca, Rattan, and wild species of palms. Among these plants, we also flushed out *species of Zeuxidia* and *Discophora*, known feeders on similar or the same plants.

Amathusia phidippus is a familiar twilight flier in most countrysides of many provinces here. It is however more numerous in the large coconut plantations where borders are usually lined with bananas. In November



Immature stages of the Cebuan form of *Amathusia phidippus*. Larva feeding on coconut leaf, and dorsal and lateral views of the pupa. The end of the pupal head is occasionally bifurcate; it is normally produced to a single point.

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of 1952, the writer spent nine days in a sizable coconut plantation near the Maria Cristina Falls in Lanao province. Here, from the eaves and under the floors of stilted huts of tenants, a good number of sleeping adults were collected. Sometimes over a dozen would appropriate dingy corners. Tuba (coconut wine) gatherers frequently find drowned or drunk individuals inside bamboo tubes, together with bees and coconut beetles. In August and September 1961, a similar opportunity was enjoyed by the writer in southern Davao. For nearly two months, the coconut plantations with their complements of bananas and bamboo thickets provided daily observation of the Mindanao form of this amathusiid. At the American-run Lais Plantation along the Pacific coast at southern Davao, these butterflies favor for their day-hiding large mango trees with spreading low branches. They sleep upside down under branches and on dense clusters of leaves.

The *Amathusia* is subject to attack by animal predators. In Davao, specifically, the Malita-Talaud-Kinangan sector, is found a goodly population of several species of Robberflies (Asilidae), and I cannot think of another place which is more spiderous. All these animals take their toll of butterflies and moths, especially the Robberflies which were frequently seen grasping a small butterfly. Crumpled wings of an *Amathusia* were seen on several webs of spiders, especially one with a strong, sticky web which sometimes can even snare a sunbird. Many specimens collected showed wings neatly clipped by either lizards,

birds, or perhaps tarsiers. Actually, a *Hestia* which soared up the coconut tree when chased was seen to become entangled in a strong web and was immediately stunned by the spider. Because of their large size, many an *Amathusia* escaped from the jaws of lizards, suffering at most about a fifth of their wings lost to the predators, which missed the vital part of the body. Uniformity of these bite marks on their wings showed that the attacks were mostly made when the prey were at rest with folded wings.

LEPIDOPTERA OVIPOSITING ON PLANTS TOXIC TO LARVAE

I can quote two East African examples analogous to those quoted by Mr. Straatman (*Journ. lepid. soc.* 16: 99-103; 1962).

Charaxes brutus Cr., and its subspecies *natalensis* Staud., with a considerable number of recorded food-plants, now lays freely on an introduced plant *Melia azedarach* L. (Meliaceae), commonly called Persian Lilac, but such larvae invariably die in their first instar despite the fact that they feed freely. On the other hand I have transferred last instar larvae from other food-plants to *M. azedarach* and they have completed their metamorphosis successfully.

Van Someren records *Charaxes lasti* Gr. Sm. as laying on *Afzelia quanzensis* Welw. (Caesalpinaceae), and I have obtained ova freely from captive females caged over the same plant. My larvae have all, however, died in the first instar and Van Someren also states that he has failed to rear the species through.

The case of the Australian subspecies of *Papilio demoleus* L. is most surprising. In India, where I have bred it in large numbers, it has a fairly wide range of food-plants belonging to the Rutaceae, and its near ally *P. demodocus* Esp. in East Africa is the same. To have diverged from the normal food-plants of the group to the extent that it cannot develop on them seems to indicate a very wide separation from the parent species.

I would like to query Mr. Straatman's use of the term "toxic" in this context; to me "toxic" implies something active or positive, but my impression is that in these cases the trouble is more passive or negative, the plants in question lacking something essential to the larva's development.

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RECENT FOODPLANT RECORDS OF THE LOOCHOOAN BUTTERFLIES

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This is a summary of the recent records pertaining to the plants fed on by the butterfly larvae, from the Okinawa Group and the Sakishima Group, among the Loochoo (Ryukyu) Islands. Additional data from the Amami Group are supplemented to these records with asterisks. All are from the actual field observations by the very enthusiastic members of the Lepidopterological Society of Japan (journal: *Tyo to Ga*), the Kagoshima Konchu Dokokai (journal: *Satsuma*), and the Keihin Konchu Dokokai (journal: *Insect Magazine*).

Hesperiidae

1. *Hasora chromus inermis* Elwes & Edwards, on *Pongamia pinnata* (Leguminosae).
2. *Choaspes benjamini japonica* Murray & *C. b. formosana* Fruhstorfer, on *Meliosma oldhami* (Sabiaceae).
3. *Tagiades trebellius martinus* Ploetz, on *Dioscorea alata, D. cirrhosa* (Dioscoreaceae).
4. *Notocrypta curvifascia curvifascia* Felder & *N. c. yaeyamana* Shirozu, on *Alpinia speciosa, A. intermedia* (Zingiberaceae).
5. *Udaspes folus* Cramer, on *Alpinia speciosa* (Zingiberaceae).
6. *Telicota colon stinga* Evans, on *Miscanthus sinensis, Microstegium sp.* (Gramineae).
7. *Parnara naso bada* Moore, on *Oryza sativa, Bambusa sp.* (Gramineae).
8. *Parnara guttata guttata* Bremer & Grey, on *Miscanthus sinensis* (Gramineae).
9. *Borbo cinnara* Wallace, on grasses (Gramineae).
10. *Pelopidas mathias oberthueri* Evans, on *Miscanthus sinensis, Imperata cylindrica, Arundo donax, Oplismenus compositus, Saccharum officinarum, Bambusa sp.* (Gramineae).

Papilionidae

1. *Byasa alcinous loochooanus* Rothschild, *B. a. bradanus* Fruhstorfer, & *B. a miyakoensis* Omoto, on *Aristolochia liukiuensis* (Aristolochiaceae).
2. *Graphium sarpedon morium* Fruhstorfer, on *Cinnamomum japonicum, Litsea japonica, Machilus thunbergii* (Lauraceae).
3. *Graphium doson perillus* Fruhstorfer, on **Michelia formosana?* (Magnoliaceae).

4. *Papilio xuthus xuthus* Linnaeus, on *Zanthoxylum beecheyanum, Fagara ailanthoides* (Rutaceae).
5. *Papilio polytes polycles* Fruhstorfer, on *Citrus depressa, Toddalia asiatica* (Rutaceae).
6. *Papilio protenor liukiuensis* Fruhstorfer, on *Citrus depressa* (Rutaceae).
7. *Papilio bianor okinawaensis* Fruhstorfer, & *P. b. junia* Jordan, on *Evodia glauca* (Rutaceae).
8. *Papilio memnon pryeri* Rothschild, on *Citrus depressa* (Rutaceae).
9. *Papilio helenus nicconicolens* Butler, on *Citrus depressa* (Rutaceae).

PIERIDAE

1. *Pieris rapae curcivora* Boisduval, on *Brassica oleracea, B. juncea, Rorippa indica* (Cruciferae).
2. *Hebomoia glaucippe liukiuensis* Fruhstorfer & *H. g. cincia* Fruhstorfer, on *Crataeva religiosa* (Capparidaceae).
3. *Catopsilia pyranthe* Linnaeus, on *Cassia obtusifolia, C. occidentalis* (Leguminosae).
4. *Catopsilia crocale* Cramer, on *Cassia siamea, C. fistula* (Leguminosae).
5. *Catopsilia pomona* Fabricius, on *Cassia siamea* (Leguminosae).
6. *Eureme hecabe subdecorata* Moore & *E. h. hobsoni* Butler, on *Leucaena glauca, Cassia occidentalis, C. fistula, C. siamea, C. surattensis, Acacia farnesiana, Lespedeza cuneata* (Leguminosae).
7. *Eurema blanda arsakia* Fruhstorfer, on *Caesalpinia nuga* ?, *Wagatea spicata* (Leguminosae).
8. *Eurema laeta bethesba* Janson, on **Cassia mimosoides* ? (Leguminosae).
9. *Colias erate poliographus* Motschulsky, on *Melilotus suaveolens* (Leguminosae).

LYCAENIDAE

1. *Narathura japonica* Murray, on *Quercus acutissima* (Fagaceae).
2. *Narathura bazalus turbata* Butler, on **Lithocarpus edulis* (Fagaceae).
3. *Deudorix eryx okinawana* Matsumura, on *Gardenia jasminoides* (Rubiaceae).
4. *Euchrysops cnejus* Fabricius, on *Vigna marina, Phaseolus angularis, Crotalaria* sp. (Leguminosae).
5. *Lampides boeticus* Linnaeus, on *Vigna marina, Phaseolus angularis, Pisum sativum, Crotalaria sessiflora* (Leguminosae).
6. *Jamides bochus ishigakianus* Shirozu, on *Pueraria montana* ?, *Pongamia pinnata, Oromacarpum cochinensis* (Leguminosae).
7. *Nacaduba kurava septentrionalis* Shirozu, on *Ardisia sieboldii*

(Myrsinaceae).

8. *Nacaduba nora kanoi* Omoto, on *Entada phaseoloides* (Leguminosae).
9. *Megisba malaya iwasakii* Matsumura, on *Mallotus japonicus* (Euphorbiaceae).
10. *Everes lacturnus kawai* Matsumura, on *Desmodium heterocarpum* (Leguminosae).
11. *Pithecops nihana ryukyuensis* Shirozu on *Desmodium caudatum, D. tashiroi* (Leguminosae).
12. *Zizina otis riukiuensis* Matsumura, on *Melilotus suaveolens, Kummerowia striata, Lespedeza cuneata, Vigna marina* (Leguminosae).
13. *Zizeeria maha okinawana* Matsumura, on *Oxalis corniculata* (Oxalidaceae).
14. *Zizeeria knysna karsandra* Moore, on *Amaranthus spinosus, A. ascendens* (Amaranthaceae).
15. *Celastrina puspa ishigakiana* Matsumura, on **Rosa wichuraiana?* (Rosaceae).
16. *Curetis acuta paracuta* de Nicéville, on **Robinia pseudoacacia* (Leguminosae).

Libytheidae

1. *Libythea celtis amamiana* Shirozu, *on celtis boninensis* (Ulmaceae). ceae).

Danaidae

1. *Limnas chrysippus* Linnaeus, on *Asclepias curassavica* (Asclepiadaceae).
2. *Salatura genutia* Cramer, on *Tylophora tanakae* (Asclepiadaceae).
3. *Radena similis similis* Linnaeus, on *Tylophora tanakae* (Asclepiadaceae).
4. *Caduga sita niphonica* Moore, on *Hoya carnosa, Marsdenia tinctoria, Asclepias curassavica* (Asclepiadaceae).
5. *Idea leuconoe riukiuensis* Holland, on *Cynanchum formosanum* (Asclepiadaceae).

Nymphalidae

1. *Argyreus hyperbius hyperbius* Linnaeus, on *Viola pseudo-japonica* (Violaceae).
2. *Precis almana* Linnaeus, on *Lippia nodiflora* (Verbenaceae), *Lindernia verbenaefolia* (Scrophulariaceae).
3. *Precis orithya* Linnaeus, on **Justica procumbens* (Acanthaceae).
4. *Vanessa cardui* Linnaeus, on *Arctium lappa* (Compositae).
5. *Vanessa indica indica* Herbst, on *Boehmeria nivea* (Urticaceae).
6. *Kaniska canace siphnos* Fruhstorfer & *K. c. ishima* Fruhstorfer, on *Smilax bracteata, S. sebeana* (Liliaceae).

7. *Hypolimnas misippus* Linnaeus, on **Portulaca oleracea* (Portulacaceae).
8. *Hypolimnas bolina philippensis* Butler, on **Ipomea adulis* (Convolvulaceae).
9. *Hypolimnas antilope truentus* Fruhstorfer, on *Villebrunea sp.* ? (Urticaceae).
10. *Kallima inachus eucerca* Fruhstorfer, on *Strobilanthes glandulifera, S. tashiroi* (Acanthaceae).
11. *Cyrestis thyodamas mabella* Fruhstorfer & *C. t. ishigakiana* Matsumura, on *Ficus septica, F. erecta* (Moraceae).
12. *Neptis hylas luculenta* Fruhstorfer, on *Pueraria montana, Glycine max* (Leguminosae).
13. *Tacoraea selenophora ishiana* Fruhstorfer, on *Mussaenda pubescens* (Rubiaceae).
14. *Dichorragia nesimachus ishigakianus* Shirozu, on **Meliosma sp.* (Sabiaceae).
15. *Polyura eudamippus weismanni* Fritze, on *Celtis boninensis* (Ulmaceae), *Rhamnella franguloides* (Rhamnaceae).
16. **Hestina assimilis shirakii* Shirozu, on **Celtis boninensis* (Ulmaceae).

SATYRIDAE

1. *Ypthima riukiuana* Matsumura, on grasses (Gramineae).
2. *Lethe europa pavida* Fruhstorfer, on *Bambusa* sp. (Graminae).
3. *Mycalesis gotama madjicosa* Butler, on *Miscanthus sinensis, Oplismenus compositus* (Gramineae).
4. *Melanitis leda leda* Linnaeus, on grasses (Gramineae).

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BUTTERFLY COLLECTING AT THE TIME OF A SOLAR ECLIPSE

by JOSEF MOUCHA

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June 30th 1954 was the day of a remarkable partial solar eclipse. This day I collected near the village of Cejkov near the Slovak-Hungarian frontier (SE of the town of Košice, E. Czechoslovakia). This locality is very interesting for the collector. During my stays in Cejkov (May 5-9th 1951, June 30th 1954, and July 13-14th 1950) I have found here 142 species of Lepidoptera, of which 58 are Rhopalocera and 42 Geometridae, all collected by day only.

In the surroundings of Cejkov are a number of biotopes, chiefly oak woods, hillsides covered with bushes and xerophilous plants, cultivated fields with different agricultural plants (for example corn, tobacco, red pepper, sunflower, etc.), and fruit-trees and vineyards also. Geographically this region belongs to the hilly country of Čergov, where some of hills reach about 350-470 m a.s.l. Towards the south is low-lying land (99-125 m a.s.l.) on the rivers Ondava and Bodrog. The locality of Cejkov is situated on the border between this lowland and the hilly region, at an elevation above sea level of about 180 m.

I observed the partial solar eclipse here on June 30th 1954. The information of the time of this solar eclipse for the village of Cejkov with the exactness of $\pm$ 15 seconds: the beginning after noon, at 12:52.2, the middle at 14:08.2, and the end at 15:18.2 of Central European time. The middle is the moment of the maximal eclipse of the solar disc. The intensity (the maximal part of the solar diameter covered by the moon) was 0.87.

Immediately after the beginning of the solar eclipse I observed a remarkable uneasiness in the diurnal species. This behavior was common in other insects also (mainly Odonata and Diptera). On this day there was a breeze, which changed during the solar eclipse to a perceptible wind. After the beginning of the eclipse the butterflies became uneasy and began searching for resting places, as before their night's rest. The Blues (Lycaenidae) came to rest on flowers, the Browns (Satyridae)

found shelter in the grass or on the under side of leaves on the border of the oak wood, but the Fritillaries (Nymphalidae) rested on thistle flowers. In a short time (about 15 minutes) after the beginning of the eclipse all butterflies were in their usual resting places without any activity and left these places only when disturbed. The behavior by the Hover-flies (Diptera, Syrphidae) was similar. On the contrary, I saw remarkable activity in some of the day-flying moths, mainly in Burnets (Zygaenidae) and *Syntomis phegea* L. (Syntomidae =Amatidae). These species were flying aimlessly, higher than usual (about 3-4 m above the ground), both into and with the wind.

On the day of the solar eclipse I collected in Cejkov the following species (see also Moucha & Novák, 1960-1962): Satyridae: *Melanargia galathea* L., *Eumenis semele* L., *Coenonympha arcania* L.; Nymphalidae: *Boloria dia* L., *Argynnis paphia* L., *Melitaea athalia* Rott., *Nymphalis polychloros* L., *Apatura ilia* Den. & Schiff.; Lycaenidae: *Cupido argiades* Pall., *Plebejus idas* L., *Glaucopsyche alexis* Poda, *Lycaena phlaeas* L., *Strymon ilicis* Esp., *Strymon acaciae* Fabr.; Pieridae: *Leptidea sinapis* L., *Leptidea morsei major* Lork., *Aporia crataegi* L., *Pieris rapae* L., *Pieris napi* L.; Hesperiidae: *Thymelicus sylvestris* Poda; Syntomidae: *Syntomis phegea* L.; Zygaenidae: *Zygaena purpuralis* Brün., *Zygaena punctum* O., *Zygaena lonicerae* Schev.; Noctuidae: *Paracolax glaucinalis* Den. & Schiff.; Arctiidae: *Hipocrita jacobeae* L.; and Geometridae: *Chiasma clathrata* L.

All these species are common in Central Europe with two exceptions. The White, *Leptidea morsei major* Lork., is a rarity in European countries; in Austria, Czechoslovakia, Hungary, and Yugoslavia it reaches the western border of its distribution. Another interesting species is the Burnet moth *Zygaena punctum* O., living only in hot, dry localities. The southern and eastern region of Slovakia is the northern limit of its distribution in Central Europe.

Summarizing these observations of the behavior of Lepidoptera during the partial solar eclipse, I can say that the butterflies stopped flying, but the activity of the heliophilous moths is normal, and of *Syntomis phegea* is, surprisingly, higher.

The changes in behavior of animals (mainly domestic) during solar eclipses are well known. Nevertheless I call collectors' attention to these observations of insects, which are much rarer.

Reference

Moucha, J., & I. Novák, 1960-1962. Ergebnisse der Erforschung der Lepidopteren-Fauna der Slowakei (1946-1960). *Acta faunistica ent. mus. nat. Pragae* 6: 45-90 (I. Teil); 8: 95-137 (II. Teil).

National Museum, Praha, CZECHOSLOVAKIA

A NEW SPECIES OF *CARGOLIA* (GEOMETRIDAE, ENNOMINAE) FROM MEXICO, WITH TRANSFERS OF SPECIES

by Charles V. Covell Jr.

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Introduction

Druce (1898) described *Amphidasis charon* on the basis of a male and a female from Jalapa, Mexico. These he figured in Plate XCVIII, figs. 23 (♀) and 24 (♂). Rindge (1961) placed the male *A. charon* in synonomy of *Phaeoura cladonia* (C. Felder, R. Felder, & Rogenhofer), and indicated that Druce's female is not conspecific with the male. Rindge selected the male as lectotype for *charon*, leaving the female nameless. Both of Druce's specimens are in the British Museum.

The author found two females labeled "charon" in the U. S. National Museum while working on the revision of *Erilophodes* (Covell, 1963). These appeared identical to the *charon* female of Druce's illustration, and were both from Mexico (Jalapa and Coatepec). A single male from Hidalgo, Mexico, corresponding in maculation to the two females, was found in the American Museum of Natural History.

This species is congeneric with *Cargolia albipuncta* Schaus (1901), also from Mexico (type locality, Jalapa), as are several species of *Neodesmodes* Warren and *Hasodima* Butler from South America. This conclusion is based on comparative studies of wing venation, maculation, and of genitalic features.

CARGOLIA CARMELITA Covell, new species
(Fig. 1)

Description. Head with proboscis well developed. Labial palpi upturned, reaching top of eyes in male, half height of eyes in female. Basal palpal segment 2.25 mm (male) and 1.5 mm (female); middle segment 2.0 mm (both sexes); terminal segment 0.9 mm (male) and 0.45 mm (female). Basal segment mostly with black-brown appressed scales, some white, with ventral scales long and hairlike; middle segment dark for basal two-thirds, then white; terminal segment white. Front slightly convex, vested with appressed, flat, white scales. Width between eyes 0.75 mm (male) and 0.8 – 0.9 mm (females). Eyes subgloboid, naked; diameter 3.45 mm (male) and 2.1 – 2.25 mm (females; ocelli absent. Antennae with scape urceolate, vested with appressed, flat, white scales (female with some dark scales dorsally). Male antennae 8 mm long, bipectinate for four-fifths of length; pectinations setaceous; shaft vested with mixture of white and dark, appressed, flat scales. Female antennae filiform, 10 mm long, with scaling as in male. Vertex of head clothed with appressed, flat, long, white scales, partly covering scape.

Thorax with patagia clothed with long, white scales with edging of black scales ventro-laterally. Tegulae mostly white, with sprinkling of dark scales. Thoracic tergites clothed with appressed, flat, white, scales, except for erect tufts of black scales present on mesothorax and metathorax. Pectus vested with long, white, hair-scales.

Abdomen clothed with appressed, flat, white scales, sprinkled with dark; erect, black tufts on dorsum of segments 1 – 5.

Legs clothed with mixture of blackish and white patches of appressed, flat scales. Male foreleg with epiphysis; hind tibia with two pairs of spines, but with no other modifications.

Forewing triangular, 17.5 mm long (male) to 22 mm (female). Termen convex to Cu_1, then very slightly concave to tornus; inner margin straight. R_1 free, from four-fifths of cell; R_2 from just beyond departure of R_1, free; $R_3+_4+_5$ from apex of cell, R_5 departing from R_3+_4 halfway from cell to margin; R_3+_4 stalked for half of remaining distance. M_1 from apex of cell; M_2 weak, from just above middle of cell; M_3 and Cu_1 from lower angle of cell; Cu_2 from three-fourths of lower margin of cell.

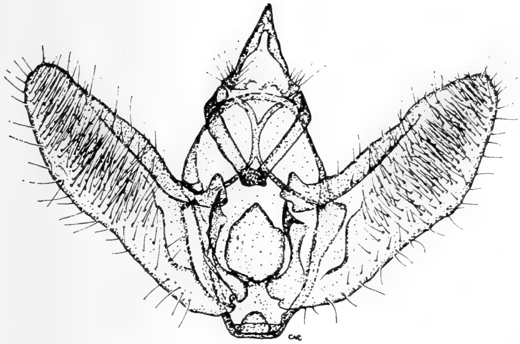
Hindwing rounded; Sc sharply bent in humeral angle, then following Rs for almost half of cell. M_1 from apex of cell; M_2 and Cu_1 dividing at lower angle of cell; Cu_2 from three-fourths of lower margin of cell. Frenulum well developed in both sexes.

Pattern of maculation as in Fig. 1. Both sexes alike except that the markings in the female are less bold and less well defined. Also the dark scaling covers the whole hindwing surface in the female, not merely forming a border as in the male.

Ground concolorous white on all wing surfaces. Basal area red-brown, lighter in female. Basal line of forewing black, broad, extending from C to inner margin, strongly convex outward between Cu and 2d A. Broad area of chocolate shading before black-brown a.m. line, separated from it by partial white line. Median area white, except for black, vertical discal dash and some light brown suffusion along C. P.m. line black, with broad chocolate postmedial shading separated from it by narrow white line. Distal part of postmedial area with black patches centered on R_5 and below Cu_2, and a large red-brown patch beginning at p.m. line, between M_3 and Cu_1. Subterminal area light brown, except for whitish apical area and black-brown area between M_1 and M_3. Terminal area marked with black-brown spots between veins below R_5 and vestigial 1st A. Fringe light brown, checkered with white.

Upper surface of hindwing in male with irregular blackish border for outer one-fourth. Vertical discal spot centered on cross veins. Triangular blackish patch at about midpoint of C. Basal two-thirds of upper surface covered with long, white hair-scales. Fringe white, with some dark scaling. Upper surface of hindwing in female heavily suffused with dark scales throughout, more concentrated toward outer margin; darker scales also form a vague median line and median spot.

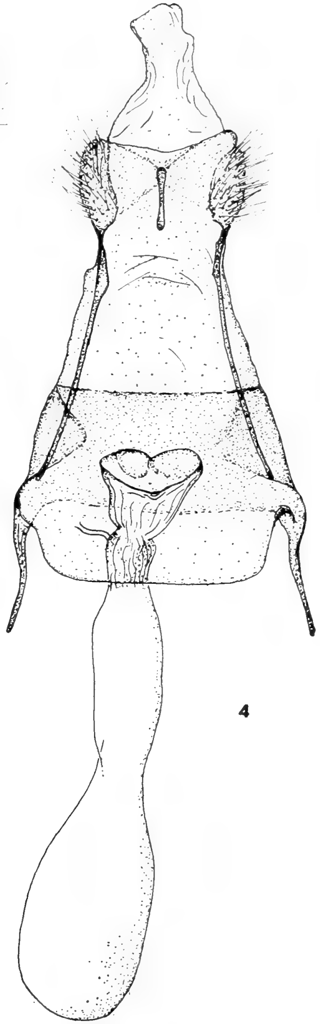
Fig. 1. Habitus of *Cargolia carmelita,* new species
Holotype male (left); paratype female (right).



2

3

1 mm



4

Fig. 2. *C. carmelita,* male genitalia. Fig. 3. *C. carmelita,* male aedeagus. Fig. 4. *C. carmelita,* female genitalia.

Lower surfaces of wings with dark areas and markings of upper surface repeated by areas of gray scales (both sexes). Dark suffusion less extensive on lower surface of female.

Male genitalia (Fig. 2) small (2.4 mm from tip of uncus to bottom of vinculum). Valvae simple, flat, membranous, more sclerotized toward costa; apices rounded; inner surface densely hairy to apices; costa ending basally in broad process, broadly pointed caudally. Uncus simple, broad-based, short, rising to rounded point. Gnathos with evenly wide straps meeting centrally in rather heavily sclerotized pad armed with many short spines. Furcae heavily sclerotized, broad-based processes rising dorsally to sharp, upcurved points. Juxta nearly hexagonal, with rather rough margins. Aedeagus (Fig. 3) small (1.45 mm long), narrower anteriorly, and gently

curved in anterior third of length; 8 spinelike cornuti of varying lengths present.

Female genitalia (Fig. 4) 7 mm long. Papillae anales broad, joined dorsally; setose; slender, heavily sclerotized plate longitudinally between lobes ventrally. Apophyses posteriores and apophyses anteriores well developed, the former about twice as long as the latter. Genital plate slightly developed and lightly sclerotized. Ostium wide, narrowing rapidly anteriorly; slight constriction at juncture of ostium and ductus bursae. Ductus seminalis arising from ductus bursae near ostium. Ductus bursae reinforced with heavily sclerotized plates laterally at point of juncture with ostium; otherwise membranous, gradually widening into corpus bursae. Corpus bursae ovoid, membranous; signum absent.

HOLOTYPE: male, "Guerrero Mill., Hidalgo, Mexico, 9,000 ft.", collected by Mann and Skewes, no date; E. L. Todd Genitalia Slide 1434; American Museum of Natural History. PARATYPES: Two females in U. S. National Museum, one labeled "Coatepec, Mexico", other labeled "Jalapa, Mexico"; both from the Wm. Schaus Collection.

Immature stages: Unknown.

DISCUSSION

Of the two Mexican species, *albipuncta* is smaller than *carmelita*, and is completely black or black-brown, with white or light-brown areas in the median area and apical area of the forewing. The maculation of the forewing of *carmelita* is similar to that of most of South America species; however, it can be distinguished by the presence of the whitish apical area of the forewing above, unmarked by black as in the other species; also, the a.m. and p.m. lines below Cu_2 in *carmelita* are nearly parallel, whereas they are obliquely divergent in the South American species.

The male genitalia of *carmelita* are very similar to those of *albipuncta*, the two differing most markedly in that the base of the juxta in *carmelita* is separated from the bases of the valvae by a distinct, irregular fracture; in *albipuncta* the base of the juxta is continuous with the bases of the valvae. These two Mexican species can best be separated from the males of the South American species in having a rather short, broad-based, almost triangular uncus; the South American species have the uncus produced into a longer, more narrow lobe.

The female genitalia of *carmelita* differ from the South American species in the apparent lack of a signum. No comparisons can be made with *albipuncta*, as its female is yet unknown.

TRANSFERS OF SPECIES

Following are the species now included in the genus *Cargolia* Schaus:

1. *C. albipuncta* Schaus, 1901, *Trans. Amer. ent. soc.* 27: 249-50. Mexico. Type species.
2. *C. carmelita* Covell, new species. Mexico.
3. *C. semialbata* (Warren), NEW COMBINATION. Peru, Bolivia.
   Neodesmodes semialbata Warren, 1905, *Nov. zool.* 12: 361.
   Erilophodes marmorinata Bastelberger, 1908, *Jahrb. Nassauischen*

Ver. Naturkunde 61: 79 - 80. (Placed in synonymy of *N. semialbata* by Covell, 1963.)

4. *C. salapia* (Druce), NEW COMBINATION. Colombia.
   Hasodima salapia Druce, 1900, *Annals & mag. nat. hist.*, ser. 7, vol.5: 522.
5. *C. arana* (Dognin), NEW COMBINATION. Colombia, Peru, Bolivia, Argentina.
   Caripeta arana Dognin, 1896, *Ann. soc. ent. Belgique* 39: 117.
   Erilophodes arana (Dognin), Warren, 1909, *Nov. zool.* 16: 109.
   Neodesmodes arana (Dognin), Covell, 1963.
6. *C. muscosa* (Dognin), NEW COMBINATION. Colombia.
   Neodesmodes muscosa Dognin, 1911, *Hétérocères nouv. Amér. Sud,* fasc.III: 38.
7. *C. pruna* (Dognin), NEW COMBINATION. Colombia, Ecuador, Peru, Bolivia.
   Bryoptera pruna Dognin, 1892, *Le Naturaliste,* 1 March 1892: p.59.
   Hasodima puta Druce, 1900, *Annals & mag. nat. hist., ser.* 7, vol.5: 522. NEW SYNONYMY.
8. *C. dardania* (Druce), NEW COMBINATION. Colombia.
   Hasodima dardania Druce, 1900, *Annals & mag. nat. hist.,* ser. 7, vol.5: 521.

In addition to these species, others from Latin America may belong in *Cargolia.* The author hopes to carry on more detailed investigation of this genus and others closely related to it, studying the biology and ecology of species as well as morphology.

Acknowledgements

The author is very grateful to Dr. E. L. Todd, A.R.S., U.S.D.A., for his advice during the course of this study. For the loan of material for study, the author wishes to thank Dr. J. F. G. Clarke (U. S. National Museum), Dr. F. H. Rindge (American Museum of Natural History), Mr. D. S. Fletcher (British Museum), Dr. J. G. Franclemont (Cornell University), Dr. C. D. MacNeill (California Academy of Science), and Mr. H. K. Clench (Carnegie Museum).

References Cited

Covell, C. V. Jr., 1963. A revision of the Neotropical genus *Erilophodes* (Lepidoptera: Geometridae). *Annals entomol. soc. Amer.* 56: 835-844.

Druce, H., 1898. *Biologia Centrali Americana, suppl.,* vol.2: 533; vol.3: pl. XCVIII, figs. 23-24.

Rindge, F. H., 1961. A revision of the Nacophorini (Lepidoptera, Geometridae). *Bull. Amer. mus. nat. hist.* 123: 113.

Schaus, W., 1901. New species of Geometridae from tropical America, part II. *Trans. Amer. ent. soc.* 27: 249-250.

CORRIGENDA FOR VOLUMES 16 AND 17

Vol. 16:

p. 106, left column – words in last two boxes should be reversed; thus, the lower left box should be "Habitat preference".

p. 119, in 3rd horizontal data row – "62", "3.75", "3.76", and "4.9583" should be "52", "3.71", "3.76", and "4.9585".
p. 123, 1st and 4th lines from bottom, and p. 124, 2nd line from top – "F_3" should be "F_1".

Vol. 17:
p. 109, bottom – line omitted just above mail address:
"9. *Adopaea lineola*: VI-10-59, Stevenson, Baltimore Co."
p. 168, 16th line from bottom – "♀ *P. protenor* × ♂ *P. helenus*" should be "♀ *P. polytes* × ♂ *P. helenus*".
p. 193, 3rd line from bottom – "Zucht *quercus*" should be "Zucht von *Marumba quercus*".
p. 195, 20th line from bottom – "524-629" should be "624-629".
p. 198, 20th line from bottom – "Yohrinori" should be "Yoshinori".

A MEXICAN SATYRID AT LIGHT

In view of the recent increased interest in Rhopalocera being attracted to light it is appropriate to note an addition to the body of information on this subject.

A large lepidopteron was taken at some time very near 9:00 pm, Pacific Standard Time, 14 November 1952, at San Blas, Nayarit, Mexico. It was sitting on the ceiling of an outdoor corridor about two feet from a yellow light of the insect-repelling type. The location was a hotel there (the only modern one at that time) on the south edge of town. The place the specimen was taken faced jungle which was about three hundred feet away. The Pacific Ocean was about two hundred feet in the opposite direction.

This specimen was recently identified, with the aid of Dr. C. L. Remington, as *Taygetis mermeria* Cramer, probably form *excavata*. Identification was based on figures in Seitz' *Macrolepidoptera of the World*, Volume 5. The specimen has been placed in the Peabody Museum of Natural History at Yale University.

ROBERT B. BUTLER, 15 Paulus Boulevard, New Brunswick, N. J., U. S. A.

BOOK NOTICE

The DYNAMICS OF EPIDEMIC SPRUCE BUDWORM POPULATIONS. Edited by R. F. Morris. Canadian Entomologist, Memoir 31, 332 pp., numerous textfigs., graphs, & halftone plates. May 21, 1963. Paper and cloth.

The spruce budworm, *Choristoneura fumiferana* (Clem.) (Tortricidae) pobably is the most intensively studied species of Lepidoptera in North America, if not in the world. Its tremdous outbreak capabilities and resultant economic importance to Canadian foresters precipitated a myriad of detailed studies on numerous aspects of its bionomics during the past 20 years.

This monograph is a series of closely related papers presenting the results of population studies on the spruce budworm. It is an attempt to ascertain and model mathematically where possible, the mode of action of the principal variables affecting density of the species. Major topics covered include general bionomics; development of outbreaks; analysis of survival and reproduction in both unsprayed and sprayed areas; a discussion of the major factors and processes affecting the bionomics, including dispersal, hosts and host conditions, parasites, predators, diseases, and insecticides. In all, twelve authors are contributors. — EDITOR

MINUTES OF THE THIRTEENTH ANNUAL MEETING OF THE LEPIDOPTERISTS' SOCIETY

The Thirteenth Annual Meeting of the Lepidopterists' Society was held at Town Hall, Wonderland Shopping City, San Antonio, Texas, on 1-2 July 1963.

At 5:00 P.M. June 30, an informal social was held and displays were arranged for the meeting.

At 8:30 A.M., July 1, registration started and at 10:00 A.M. the meeting was called to order by H. A. Freeman and several announcements were made by Roy O. Kendall. The Presidential address of H. B. D. Kettlewell was read by J. W. Tilden. With H. A. Freeman presiding, the first discussion presented was a round table on good collecting spots in Texas, by André Blanchard, Jack E. Lipes and H. A. Freeman. This was followed by a report on "Federal Plant Pest Regulations" by Jack E. Lipes. The last talk during the morning session was by Roy O. Kendall on "A technique for stimulating oviposition".

The afternoon session was called to order by H. A. Freeman at 2:00 P.M., and he presented the first discussion on "Effects of pH on the distribution of the Megathymidae". P. A. Glick followed with his talk on "Collecting lepidoptera by airplane". N. E. Flitters presented next a very interesting discussion on "Photographing life histories", with a moving color pictorial. J. M. Burns than gave a well prepared discussion on "Notes on a new skipper from Texas". The last paper was the "Devastation by human and natural elements to Yucatecan forests, with corresponding changes in insect abundance and the formation of Peninsular microclimates", written by E. C. Welling and read by André Blanchard.

Beginning at 7:30 Monday evening an informal social was held. Exhibits were examined, trading was carried on and a very fine time was had by all.

The morning session, July 2, was called to order at 8:30 by Roy O. Kendall, and the first article discussed was "Distribution, distribution-limiting factors, and differentiation in *Erynnis*" by J. M. Burns; this was a very informative discussion. Following this Don B. Stallings gave an interesting talk on the "Comparative life history of *Megathymus ursus* and *Megathymus violae*." This was followed by Harry K. Clench's discussion of "*Hemiargus huntingtoni* - its discovery and range extension". The next part of the program was a round table discussion presented by P. A. Glick, "Light traps - an important aid to the lepidopterist", Joe P. Hollingsworth, "Engineering aspects of electric insect traps", and André Blanchard, "*Catocala* collecting with light". The round table was well presented as slides, models and techniques involving the use of

various kinds of light traps were shown and discussed. The next was a paper on "Larval foodplants", by Roy O. Kendall, which was very informative. The last paper, by C. A. & Doris Anderson on "On the wings of the Monarch butterfly", was read by Dr. Burns.

At 1:00 P.M. the business meeting was held with Dr. Tilden presiding and Mr. Freeman secretary *pro tem.* Suggestions were presented as to where the next meeting could be held. Mr. Clench suggested Carnegie Museum for the 1964 meeting. Lloyd Martin suggested Cornell University. Dr. Tilden suggested Yale University. It was proposed that these three locations be presented and then André Blanchard suggested as a rider that it be held at Lake Placid, Archbold Biological Station, in Florida, and most members expressed their opinions that any of the locations would be very good for the 1964 meeting. The meeting closed with expressions of thanks to Connie and Roy O. Kendall for the hard work they had done in arranging and conducting such a successful 13th Annual Meeting of the Lepidopterists' Society.

At 7:15 Tuesday evening a very fine informal dinner was held at Casa Rio, terminating with a boat ride up the San Antonio River.

The following day the Blanchards, Kendalls and Tidwells proceeded to the Welder Wildlife Foundation Refuge for a field trip, where several enjoyable days were spent collecting.

The following members and guests were present: Mr. & Mrs. Roy O. Kendall, Mr. & Mrs. Roy W. Quillin, Mr. & Mrs. André Blanchard, Perry A. Glick, Norman E. Flitters, E. M. Kinch, Robert Braubach, Mr. & Mrs. Kenneth B. Tidwell & family, J. W. Tilden, Lloyd M. Martin, John M. Burns, Scott L. Ellis & father, Mr. & Mrs. Don B. Stallings, Mr. & Mrs. Harry K. Clench & family, Joe Robinowitz, Mr. & Mrs. Jack E. Lipes & daughter Susi, Kathleen Moore & mother, J. P. Hollingsworth, C. A. Lipscomb & son, Rev. & Mrs. F. G. Butler & 3 daughters, Rolland R. Grabbe, Laura June Whitworth, Charles J. Long, and Mr. & Mrs. H. A. Freeman and son Gilbert.

Respectfully submitted,
H. A. Freeman, Secretary *pro tem.*

HOLOMELINA AURANTIACA BUCHHOLZI, A CORRECTION

In my article describing the new subspecies, under disposition of specimens (*Journ. lepid. soc.* 17: 102; 1963) it was stated that both primary types were deposited in Chicago Natural History Museum. This was due to a misunderstanding, and both Holotype male and Allotype female have been transferred to and are now in the collection of the American Museum of Natural History in New York.

Alex K. Wyatt, Chicago Natural History Museum, Chicago 5, Ill., U. S. A.

RECENT LITERATURE ON LEPIDOPTERA

Under this heading are included abstracts of papers and books of interest to lepidopterists. The world's literature is searched systematically, and it is intended that every work on Lepidoptera published after 1946 will be noticed here. Papers of only local interest and papers from this *Journal* are listed without abstract. Readers, not in North America, interested in assisting with this very large task, are invited to write Dr. P. F. Bellinger (Dept. of Natural Sciences, San Fernando Valley State College, Northridge, Calif., U. S. A.). Abstractors' initials are as follows:

[P.B.] – P. F. Bellinger	[W.H.] – W. Hackman	[N.O.] – N. S. Obraztsov
[I.C.] – I. F. B. Common	[T.I.] – Taro Iwase	[C.R.] – C. L. Remington
[W.C.] – W. C. Cook	[J.M.] – J. Moucha	[J.T.] – J. W. Tilden
[A.D.] – A. Diakonoff	[E.M.] – E. G. Munroe	[P.V.] – P. E. L. Viette

A. GENERAL

Remington, Jeanne E., & Charles L., "Mimicry, a test of evolutionary theory." *Yale scientific Mag.*, vol.32: pp.10-21, 5 figs. 1957. Review with new evidence and examples, of the theoretical basis for protective resemblance of one species to another, and of evidence for validity of theory and for mechanisms producing & maintaining mimetic resemblances; examples mainly from Lepidoptera. [P. B.]

Roepke, W. K. J., "Enkele voorbeelden van opvallende mimicry (Lep., Col., Hym.)" [in Dutch]. *Tijdschr. Ent.*, vol.91: pp.xcvii-xcviii. 1952. Notes on Ægeriidæ mimicking Hymenoptera. [P. B.]

Sevastopulo, D. G., "The biology of *Danaus chrysippus* L." *Journ. Bombay nat. Hist. Soc.*, vol.47: pp.769-771. 1948. Miscellaneous notes on habits, appearance, & variation in early stages and adult. Larvae rejected by birds and a lizard. [P. B.]

Sevastopulo, D. G., "The influence of migrant birds on butterfly mimicry." *Journ. Bombay nat. Hist. Soc.*, vol.47: pp.559-561. 1948. Doubts that a butterfly can gain any protection by resemblance to a distasteful species at the other end of a migrant bird's range. Suggests that a general resemblance between model & mimic (in same locality) will give some protection to latter. [P. B.]

Sevastopulo, D. G., "Notes on rearing *Herse convolvuli* L." *Ent. Rec. & Journ. Var.*, vol.64: pp.41-42. 1952. On variation, especially color dimorphism, in larvae; thinks larval color partly determined by activity, partly genetic. [P. B.]

Sevastopulo, D. G., "Birds and insects." *Ent. mo. Mag.*, vol.87: p.102. 1951. Includes records of birds attacking Lepidoptera; mentions examples of spp. of *Amauris, Acræa,* & *Mylothris* with beak marks. [P. B.]

Sevastopulo, D. G., "Aposematic butterflies protected by the poisonous qualities of their larval foodplants." *Journ. Bombay nat. Hist. Soc.*, vol.50: pp.951-952. 1952. Not all aposematic spp. feed on poisonous plants, and not all spp. feeding on such plants are aposematic. [P. B.]

Sevastopulo, D. G., "Food of a captive chameleon." *Entomologist,* vol.86: pp.198-199. 1953. Animal released 2 syntomids & *Porthesia* spp., ate a noctuid. [P. B.]

Tinbergen, N., "Defense by color." *Sci. Amer.*, vol.197, no.4: pp.49-53, 7 figs. 1957. Popular account of protective & warning coloration; effectiveness of countershading, protective resemblance, and such markings as eyespots are noted. [P. B.]

White, E. Barton, "Birds and butterflies." *Ent. Rec. & Journ. Var.*, vol.65: pp.55-56. 1953. Butterflies & a moth attacked by *Muscicapa griseola.* [P. B.]

Young, L., "Bag-moths attacked by Shrike-tits." *Victorian Nat.*, vol.65: p.127. 1948. Records attacks by the Eastern Shrike-tit (*Falcunculus frontatus*) on case-bearing larvae of Psychidae. [I. C.]

F. BIOLOGY AND IMMATURE STAGES

Yamafuji, K., M. Eto, & F. Yoshihara, "Effect of nuclear preparations from infected Silkworms on the development of polyhedrosis" [in English; German summary].

Enzymologia, vol.17: pp.164-168. 1954. Injection of these preparations increased number of larvae of *Bombyx mori* becoming diseased after injection of virus. [P. B.]

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E. DISTRIBUTION AND PHENOLOGY

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J. MISCELLANEOUS

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Ferguson, Douglas C., "Taxonomic and biological studies of the noctuoid and geometroid moths of Florida." *Yearbook Amer. Philos. Soc.* 1962: pp.285-288. 1963. Report on trip to Florida, mainly to duplicate 1838 collecting by Edward Doubleday at St. John's Bluff in Putnam Co. Notes *Hemaris gracilis* and *Spilosoma prima* are new Florida records. Species reared, and captivity foodplants: *Apantesis placentia* (dandelion), *Dasychira manto* (pine), *Hyparpax perophoroides* (oak), *Semiothisa distribuaria* (pine), *Nemoria lixaria* (oak), *Therina* sp. (oak), *Metarranthis obfirmaria* (cherry). Reports blend zone between mainland U. S. A. and southern Florida populations of *Papilio troilus.* [C. R.]

Tjonneland, Audfinn, "Light trap catches of two species of Lepidoptera: *Meganaclia perpusilla* Walk. (Syntomidae) and *Rhanidophora cinctigutta* Walk. (Noctuidae) in Jinja, Uganda." *Contrib. Fac. Sci. Univ. College Addis Ababa, ser. C (Zool.),* no. 2: 7 pp., 1 fig. 1962. At Robinson mercury-vaper trap, emptied every 10 minutes, both species had peak activity 2 or 3 hrs. after sunset, with noctuid activity continuing more strongly through the night; maximum numbers during rainy season (Feb.-June). [C. R.]

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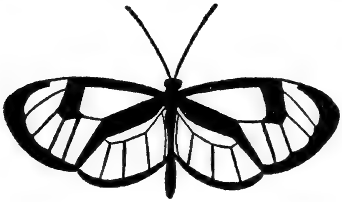

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Journal of The Lepidopterists' Society

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LARVAL FOODPLANTS FOR TWENTY-SIX SPECIES OF RHOPALOCERA (PAPILIONOIDEA) FROM TEXAS

by Roy O. Kendall

135 Vaughan Place, San Antonio, Texas

This is another in a series of papers which, it is hoped, will eventually report at least one local larval foodplant for each species of Rhopalocera resident in Texas. At present, larval foodplants are known for only one third of the more than 300 species which have been collected in the State. Larval foodplants and distributional notes are given for 26 of the following species and subspecies.

PAPILIONIDAE

Battus polydamas lucayus (Rothschild & Jordan), *Battus philenor* (Linnaeus), *Graphium marcellus* (Cramer), *Papilio multicaudata* Kirby, *Papilio polyxenes asterius* Stoll, *Papilio cresphontes* Cramer, *Papilio palamedes* Drury, *Papilio troilus ilioneus* Smith

SATYRIDAE

Euptychia cymela (Cramer), *Euptychia hermes sosybius* (Fabricius), *Euptychia gemma freemani* (Stallings & Turner), *Euptychia dorothea* (Nabokov)

NYMPHALIDAE

Dymasia dymas (Edwards), *Chlosyne gorgone carlota* (Reakirt), *Phyciodes tharos* (Drury), *Phyciodes picta* Edwards, *Phyciodes phaon* Edwards, *Phyciodes texana* (Edwards), *Anartia jatrophae luteipicta* Fruhstorfer

LYCAENIDAE

Phaeostrymon alcestis alcestis (Edwards), *Phaeostrymon alcestis oslari* (Dyar), *Satyrium calanus falacer* (Godart), *Callophrys henrici solatus* (Cook & Watson), *Euristrymon ontario autolycus* (Edwards), *Strymon melinus franki* Field, *Strymon laceyi* (Barnes & McDunnough), *Hemiargus isola* (Reakirt), *Hemiargus ceraunus zacheina* (Butler & Druce)

Each of these species and subspecies is treated separately in the order given. A chart of larval foodplants arranged alphabetically by plant family and genus, summarizes these data.

Battus polydamas lucayus (Rothschild & Jordan)

Unlike *B. philenor, lucayus* thrives on *Aristolochia elegans* Cab. which appears to be its principal larval foodplant locally. This tail-less swallowtail is well established in San Antonio, where it flies from March to mid December. Adults emerge from overwintering pupae in March and April. Peak emergence occurs from August through October. The best place to find this butterfly is near its larval foodplant.

Bexar County Texas, 3 August 1957. Four larvae were found on *A. elegans* growing in the laboratory garden. One was lost, the remaining three pupated 10, 11, 13 August. Adults emerged 23 - 25 August 1957. Eggs were found 12 October 1957 and reared to maturity. An egg laying female was taken 9 August 1958; additional ova were deposited in captivity. Adults were reared from these eggs. Another female was observed 13 September ovipositing on this plant. From eggs found 16 November 1958, a few pupae overwintered. Adults emerged from these pupae 14 March to 19 April 1959. Soon after these emergences, eggs were again found on the *A. elegans* which indicated that others had emerged in nature about the same time as those in the laboratory. From these ova, the first larva pupated 20 July 1959. By 30 July many more eggs were to be found on the plant. Observations disclosed first instar larvae on 26 August and 21 September 1959. In 1960 eggs appeared 17, 19 and 31 July, 9 and 18 September. First instar larvae were observed 27 August. A few pupae remained in diapause until 16 March 1961. Throughout 1961 and 1962, eggs, larvae and adults appeared at about the same time as in previous years.

A test of foodplant specificity was conducted 14 October 1961. A small twig of *A. elegans* containing a cluster of first instar larvae was placed in a container with *A. longiflora*. When the larvae had eaten all of the leaves of *A. elegans* they moved to the *A. longiflora* and ate it as though no change had been made. A good number were reared to maturity. Immatures have not been found in nature on *A. longiflora.*

The writer has not taken this species in any other Texas County. This is probably because he has done very little city collecting other than in San Antonio. He has one sight record from Comal County 9 August 1959.

Battus philenor philenor (*Linnaeus*)

In southern Texas this insect is very common from February to October. Although specimens have been taken 25 December and 29 January, the period November through January is the least likely to find adults.

The chief larval foodplant in this area is *Aristolochia longiflora* Engelm. & Gray. For the collector who is not familiar with this plant, it has low ascending stems with linear leaves resembling blades of grass. Every year since 1955 the writer has been presented with larvae of this species by friends who know his interest in caterpillars. Each time this question is asked: "What were they eating?" The reply is always the same: "Grass".

Most botanists agree that this plant is very difficult to find. By far the simplest and easiest way to locate *A. longiflora* is to follow an egg laying *B. philenor.* After the first brood of the season, it is practically impossible to find this plant by any other means because larvae keep it eaten to the ground. Many times this butterfly has been followed only to find a single blade of *A. longiflora.* Even though the plant is repeatedly eaten to the ground, it continues to put forth new growth from its large tuberous root.

It is generally believed that *B. philenor* larvae will feed on all species of *Aristolochia.* One exception to this is *A. elegans* Cab. which does not meet with larval taste satisfaction. Straatman (1962) found it toxic to larvae of two other lepidopterous species which normally feed on *Aristolochia.*

Bexar County Texas, 1955. Late in the season a seedling *A. elegans* was obtained for the purpose of attracting *B. philenor.* It was not visited by this insect until the following year when the vine grew to a good height. On 13 June 1956 three clusters of eggs were found. Two more appeared the following day. These eggs were removed and placed in small containers for observation. Newly hatched larvae were offered juvenile leaves of *A. elegans* which they sampled and then refused to eat more. The operation has been repeated many times since with the same results, but females continue to deposit their eggs on the plant. On 20 June 1957 a half-grown larva was found feeding on *A. elegans.* It died during pupation. Three more larvae made it through the first instar and then died 9 October 1959. A third instar larva was found 7 July 1950 and this one made it to maturity. In the years to come it will be interesting to see if *B. philenor* larvae develop a tolerance for the appearent toxic properties of *A. elegans.* It seems probable that this plant is really not toxic but only distastful to *B. philenor* larvae. After all, starvation can be as lethal as toxicity.

About four feet from the laboratory garden *A. elegans,* grows a nice clump of *A. longiflora.* Most females are attracted to the larger *A. elegans.* A female was observed ovipositing on *A. elegans* 23 August 1959. It was netted and placed over the clump of *A. longiflora* but it refused to oviposit and was released. Upon release it flew directly to

A. elegans and resumed egg laying.

The writer has collected *B. philenor* in 41 other Texas Counties as follows: Atascosa (25 Feb. 61, 12 Nov. 62), Bastrop (2 Sept. 61, 19-20 May, 26 Aug., 30 Sept. 62), Bee (3 Sept. 62), Brazos (30 Sept. 62), Brewster (7 June 60), Burnet (24 Sept. 60), Caldwell (19 May 62), Comal (10 May 57, 24 May 58, 22 May, 62), Goliad (25 Feb. 62), Gonzales (2 Mar. 57, 10 June 61, 27 Apr., 7 July, 25 Aug. 6 Aug. 60, 21 May 62), Concho (3 Aug. 61), El Paso (15 June 60), Frio (4 Feb. Aug. 62), Hidalgo (19 Mar. 61), Hill (22 Sept. 62), Jeff Davis (8-10 June 60), Jim Wells (17 Apr. 62), Johnson (22 Sept. 62), Karnes (25 Feb., 3 Sept. 62), Kerr (17 June 60, 30 June 62), Kimble (16 June 60), Kinney (30 Apr. 61), Lee (30 Sept. 62), Live Oak (26 Nov. 61, 10 Nov. 62), Madison (30 Sept. 62), Mason (14 Aug. 61), McCulloch (14 Aug. 61), Nueces (19 Apr., 1 Sept., 10 & 24 Nov. 62), Pecos (16 June 60), Presidio (11 June 60), Reeves (9 June 60), Refugio (25 Feb. 62), Rockwall (23 Sept. 62), San Jacinto (14 Apr. 62), San Patricio (10 Sept. 60, 7-8 Oct., 24 Nov. 61, 22-25 Feb., 1-25 Apr., 2 Sept., 11 & 20 Nov. 62), Sutton (16 June 60), Travis (2 & 5 Sept. 60), Uvalde (30 Apr., 4 May 61, 10 Mar. 62), Val Verde (30 Apr. 61), Victoria (13 Apr. 62), Wilson (20 Mar. 60, 25 Feb. 61, 25 Feb. 62).

Graphium marcellus marcellus (Cramer)

This species may be found in wooded areas of eastern Texas where its larval foodplant, *Asimina parviflora* (Michx.) Dunal, grows. It flies from late March to early September. Adults emerge from pupal diapause in late March and April. The best place to find *marcellus* is along sunny forest trails and openings.

Polk County Texas, 14 April 1962. After indicating a desire to rear this beautiful butterfly, André Blanchard of Houston, Texas, very generously pointed out exact locations where he had taken it on previous occasions. It was midmorning and cool when we arrived at the first spot. We drove slowly along a forest trail looking for the larval foodplant. We were examining the first plants for larvae when an adult came along. Of the ten or more seen during the next two hours, only one tattered male was taken. Searching for immatures proved more successful. Inventory disclosed eight first instar larvae and 16 ova. Blanchard insisted that the writer keep all immatures, so after visiting a few other favorite spots and filling an ice chest with pawpaw, *A. parviflora,* we returned to Houston.

Laboratory rearing was very successful. Except for crushed leaves the foodplant kept well under refrigeration. Ten pupae were obtained; all other immatures including one pupa were preserved. Adults emerged 18 May (1♀), 19 May (2♀♀), 6 June (1♂) and 31 August (1♀). The four remaining pupae emerged the following year: 25 March (1♂), 27 March (1♂, 1♀) and 11 April (1♀).

Papilio multicaudata Kirby

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LARVAL FOODPLANTS FOR TWENTY-SIX SPECIES OF RHOPALOCERA (PAPILIONOIDEA) FROM TEXAS

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This is another in a series of papers which, it is hoped, will eventually report at least one local larval foodplant for each species of Rhopalocera resident in Texas. At present, larval foodplants are known for only one third of the more than 300 species which have been collected in the State. Larval foodplants and distributional notes are given for 26 of the following species and subspecies.

PAPILIONIDAE

Battus polydamas lucayus (Rothschild & Jordan), *Battus philenor* (Linnaeus), *Graphium marcellus* (Cramer), *Papilio multicaudata* Kirby, *Papilio polyxenes asterius* Stoll, *Papilio cresphontes* Cramer, *Papilio palamedes* Drury, *Papilio troilus ilioneus* Smith

SATYRIDAE

Euptychia cymela (Cramer), *Euptychia hermes sosybius* (Fabricius), *Euptychia gemma freemani* (Stallings & Turner), *Euptychia dorothea* (Nabokov)

NYMPHALIDAE

Dymasia dymas (Edwards), *Chlosyne gorgone carlota* (Reakirt), *Phyciodes tharos* (Drury), *Phyciodes picta* Edwards, *Phyciodes phaon* Edwards, *Phyciodes texana* (Edwards), *Anartia jatrophae luteipicta* Fruhstorfer

LYCAENIDAE

Phaeostrymon alcestis alcestis (Edwards), *Phaeostrymon alcestis oslari* (Dyar), *Satyrium calanus falacer* (Godart), *Callophrys henrici solatus* (Cook & Watson), *Euristrymon ontario autolycus* (Edwards), *Strymon melinus franki* Field, *Strymon laceyi* (Barnes & McDunnough), *Hemiargus isola* (Reakirt), *Hemiargus ceraunus zacheina* (Butler & Druce)

Each of these species and subspecies is treated separately in the order given. A chart of larval foodplants arranged alphabetically by plant family and genus, summarizes these data.

Battus polydamas lucayus (Rothschild & Jordan)

Unlike *B. philenor, lucayus* thrives on *Aristolochia elegans* Cab. which appears to be its principal larval foodplant locally. This tail-less swallowtail is well established in San Antonio, where it flies from March to mid December. Adults emerge from overwintering pupae in March and April. Peak emergence occurs from August through October. The best place to find this butterfly is near its larval foodplant.

Bexar County Texas, 3 August 1957. Four larvae were found on *A. elegans* growing in the laboratory garden. One was lost, the remaining three pupated 10, 11, 13 August. Adults emerged 23 - 25 August 1957. Eggs were found 12 October 1957 and reared to maturity. An egg laying female was taken 9 August 1958; additional ova were deposited in captivity. Adults were reared from these eggs. Another female was observed 13 September ovipositing on this plant. From eggs found 16 November 1958, a few pupae overwintered. Adults emerged from these pupae 14 March to 19 April 1959. Soon after these emergences, eggs were again found on the *A. elegans* which indicated that others had emerged in nature about the same time as those in the laboratory. From these ova, the first larva pupated 20 July 1959. By 30 July many more eggs were to be found on the plant. Observations disclosed first instar larvae on 26 August and 21 September 1959. In 1960 eggs appeared 17, 19 and 31 July, 9 and 18 September. First instar larvae were observed 27 August. A few pupae remained in diapause until 16 March 1961. Throughout 1961 and 1962, eggs, larvae and adults appeared at about the same time as in previous years.

A test of foodplant specificity was conducted 14 October 1961. A small twig of *A. elegans* containing a cluster of first instar larvae was placed in a container with *A. longiflora.* When the larvae had eaten all of the leaves of *A. elegans* they moved to the *A. longiflora* and ate it as though no change had been made. A good number were reared to maturity. Immatures have not been found in nature on *A. longiflora.*

The writer has not taken this species in any other Texas County. This is probably because he has done very little city collecting other than in San Antonio. He has one sight record from Comal County 9 August 1959.

Battus philenor philenor (*Linnaeus*)

In southern Texas this insect is very common from February to October. Although specimens have been taken 25 December and 29 January, the period November through January is the least likely to find adults.

The chief larval foodplant in this area is *Aristolochia longiflora* Engelm. & Gray. For the collector who is not familiar with this plant, it has low ascending stems with linear leaves resembling blades of grass. Every year since 1955 the writer has been presented with larvae of this species by friends who know his interest in caterpillars. Each time this question is asked: "What were they eating?" The reply is always the same: "Grass".

Most botanists agree that this plant is very difficult to find. By far the simplest and easiest way to locate *A. longiflora* is to follow an egg laying *B. philenor*. After the first brood of the season, it is practically impossible to find this plant by any other means because larvae keep it eaten to the ground. Many times this butterfly has been followed only to find a single blade of *A. longiflora*. Even though the plant is repeatedly eaten to the ground, it continues to put forth new growth from its large tuberous root.

It is generally believed that *B. philenor* larvae will feed on all species of *Aristolochia*. One exception to this is *A. elegans* Cab. which does not meet with larval taste satisfaction. Straatman (1962) found it toxic to larvae of two other lepidopterous species which normally feed on *Aristolochia*.

Bexar County Texas, 1955. Late in the season a seedling *A. elegans* was obtained for the purpose of attracting *B. philenor*. It was not visited by this insect until the following year when the vine grew to a good height. On 13 June 1956 three clusters of eggs were found. Two more appeared the following day. These eggs were removed and placed in small containers for observation. Newly hatched larvae were offered juvenile leaves of *A. elegans* which they sampled and then refused to eat more. The operation has been repeated many times since with the same results, but females continue to deposit their eggs on the plant. On 20 June 1957 a half-grown larva was found feeding on *A. elegans*. It died during pupation. Three more larvae made it through the first instar and then died 9 October 1959. A third instar larva was found 7 July 1950 and this one made it to maturity. In the years to come it will be interesting to see if *B. philenor* larvae develop a tolerance for the appearent toxic properties of *A. elegans*. It seems probable that this plant is really not toxic but only distastful to *B. philenor* larvae. After all, starvation can be as lethal as toxicity.

About four feet from the laboratory garden *A. elegans*, grows a nice clump of *A. longiflora*. Most females are attracted to the larger *A. elegans*. A female was observed ovipositing on *A. elegans* 23 August 1959. It was netted and placed over the clump of *A. longiflora* but it refused to oviposit and was released. Upon release it flew directly to

A. elegans and resumed egg laying.

The writer has collected *B. philenor* in 41 other Texas Counties as follows: Atascosa (25 Feb. 61, 12 Nov. 62), Bastrop (2 Sept. 61, 19-20 May, 26 Aug., 30 Sept. 62), Bee (3 Sept. 62), Brazos (30 Sept. 62), Brewster (7 June 60), Burnet (24 Sept. 60), Caldwell (19 May 62), Comal (10 May 57, 24 May 58, 22 May, 62), Goliad (25 Feb. 62), Gonzales (2 Mar. 57, 10 June 61, 27 Apr., 7 July, 25 Aug. 6 Aug. 60, 21 May 62), Concho (3 Aug. 61), El Paso (15 June 60), Frio (4 Feb. Aug. 62), Hidalgo (19 Mar. 61), Hill (22 Sept. 62), Jeff Davis (8-10 June 60), Jim Wells (17 Apr. 62), Johnson (22 Sept. 62), Karnes (25 Feb., 3 Sept. 62), Kerr (17 June 60, 30 June 62), Kimble (16 June 60), Kinney (30 Apr. 61), Lee (30 Sept. 62), Live Oak (26 Nov. 61, 10 Nov. 62), Madison (30 Sept. 62), Mason (14 Aug. 61), McCulloch (14 Aug. 61), Nueces (19 Apr., 1 Sept., 10 & 24 Nov. 62), Pecos (16 June 60), Presidio (11 June 60), Reeves (9 June 60), Refugio (25 Feb. 62), Rockwall (23 Sept. 62), San Jacinto (14 Apr. 62), San Patricio (10 Sept. 60, 7-8 Oct., 24 Nov. 61, 22-25 Feb., 1-25 Apr., 2 Sept., 11 & 20 Nov. 62), Sutton (16 June 60), Travis (2 & 5 Sept. 60), Uvalde (30 Apr., 4 May 61, 10 Mar. 62), Val Verde (30 Apr. 61), Victoria (13 Apr. 62), Wilson (20 Mar. 60, 25 Feb. 61, 25 Feb. 62).

Graphium marcellus marcellus (Cramer)

This species may be found in wooded areas of eastern Texas where its larval foodplant, *Asimina parviflora* (Michx.) Dunal, grows. It flies from late March to early September. Adults emerge from pupal diapause in late March and April. The best place to find *marcellus* is along sunny forest trails and openings.

Polk County Texas, 14 April 1962. After indicating a desire to rear this beautiful butterfly, André Blanchard of Houston, Texas, very generously pointed out exact locations where he had taken it on previous occasions. It was midmorning and cool when we arrived at the first spot. We drove slowly along a forest trail looking for the larval foodplant. We were examining the first plants for larvae when an adult came along. Of the ten or more seen during the next two hours, only one tattered male was taken. Searching for immatures proved more successful. Inventory disclosed eight first instar larvae and 16 ova. Blanchard insisted that the writer keep all immatures, so after visiting a few other favorite spots and filling an ice chest with pawpaw, *A. parviflora,* we returned to Houston.

Laboratory rearing was very successful. Except for crushed leaves the foodplant kept well under refrigeration. Ten pupae were obtained; all other immatures including one pupa were preserved. Adults emerged 18 May (1♀), 19 May (2♀♀), 6 June (1♂) and 31 August (1♀). The four remaining pupae emerged the following year: 25 March (1♂), 27 March (1♂, 1♀) and 11 April (1♀).

Papilio multicaudata Kirby

This magnificent swallowtail is well established in Texas. Its range here appears to be the Edwards Plateau, westward to El Paso and northward through the Panhandle. A notable exception is a female in

on *Siphonoglossa pilosella* (Nees) Torr. A brief search disclosed the plant to be growing within a few feet of where *dymas* was taken.

Twenty eggs were deposited 17, 18 June 1960 on *S. pilosella.* Judging from the abdomen size, few eggs had been deposited prior to capture. It died 18 June. For some unknown reason only four eggs hatched, and these on 20 June. The larvae readily ate *S. pilosella;* the first pupated 3 July. At this time one last instar larva was given to W. A. Pluemer for photographing. It too pupated (4 July ?) before he could make the picture. The larva, a bit of the foodplant in a vial of water, and these inside a half-gallon cylindrical paper container with a tight fitting lid, had been delivered to the photographer. A female emerged on or about 8 July and was returned 11 July. It was then discovered that eggs had been deposited on the *S. pilosella.* The container had remained covered at all times except when Mr. Pluemer discovered the emergence. There were three clusters of eggs; one of nine, one of seven and one of three plus two singles for a total of 21. The other two larvae pupated 5 and 6 July. Adults emerged 7 July (♂), 9 July (♀) and 10 July (♀).

Although rearing of this species was limited to laboratory experiment, further research will most likely show that *D. dymas* selects *S. pilosella* in nature as a larval foodplant.

The writer examined a female taken 21 October 1962 at Helotes, Bexar County, Texas by Roy W. Quillin. It was flying with *Texola elada.*

San Patricio County, 14 October 1963. At the Welder Wildlife Foundation Refuge six females were taken flying about and visiting the blossoms of *S. pilosella.*

Chlosyne gorgone carlota (Reakirt)

This butterfly seems to inhabit the northern portion of Texas where it is widely distributed and common locally. Additional field work is required to determine the number of broods and fix its range within Texas.

Bastrop County Texas, 20 May 1962. On Texas Highway 71 beneath the Colorado River bridge at Bastrop, adults were flying in good numbers. Two females were kept alive for eggs; one of these was taken *in copula.* Each female deposited but one cluster of eggs, these on 20 and 21 May. The first cluster started hatching at 10:00 PM CST 25 May; the other was not observed emerging until 6:00 AM 27 May. Larvae were offered *Helianthus annuus* L. which they accepted. The first larva pupated 9 June. Adults emerged: 13 June (1♂), 14 June (11♂♂, 1♀), 15 June (26♂♂, 6♀♀), 16 June (50♂♂, 11♀♀), 17 June (19♂♂, 55♀♀), 18 June (5♂♂, 26♀♀), 19 June (2♂♂, 9♀♀), 20 June (3♂♂, 11♀♀), 21 June (2♂♂, 3♀♀), 22 June (3♂♂, 6♀♀), 23 June (1♂, 4♀♀), 24

June (1♂, 1♀) for a total of 124 ♂♂ and 133 ♀♀. In addition, eggs, 30 pupae and an equal number of larvae were preserved. An undetermined number of larvae entered diapause about 12 June.

Stonewall County Texas, 13 August 1961. One male was taken and others were seen at a roadside park on U.S. Highway 83 where it crosses the Double Mountain Fork of the Brazos River.

Tarrant County Texas, 16 June 1961. A few larvae were received from Mr. E. M. Kinch of Fort Worth which he found in nature on *H. annuus*. Three of the larvae had pupated in transit; a forth pupated 20 June. The remaining larvae entered diapause but later died. Adults emerged 20 June (♂), 24 June (♂) and 28 June (2♀♀). Again on 25 June 1962 more larvae and pupae were received from Mr. Kinch. From these, adults emerged 26 June (♂), 27 June (3♂♂), 30 June (2♀♀), 2 July (3♀♀), 4 July (1♂, 1♀) and 5 July (♂).

Phyciodes tharos tharos (Drury)

The Pearl Crescent may be found in every major floral area of Texas. It has been collected from April to November.

Gonzales County Texas, 10 June 1961. At Palmetto State Park a female was observed to oviposit on *Aster prealtus* Poir. The female very slowly deposited 105 eggs beneath a terminal leaf. Ova were placed in a partial double-decker mass. Examination of another plant from which an adult was flushed disclosed a second mass of eggs. The captive female deposited additional ova 11 June then died. Eggs found in nature started hatching about 6:00 AM CST 12 June; those from the captive female, 14 June. Larvae were reared to maturity on *A. prealtus;* the first pupated 7 July. Adults emerged: 5 July (1♂), 6 July (2♂♂), 7 July (2♀♀), 11 July (3♂♂), 12 July (2♂♂), 13 July 12♂♂, 4♀♀), 14 July (3♂♂, 2♀♀), 15 July (4♂♂, 10♀♀), 16 July (1♂, 1♀), 17 July (2♀♀) and 18 July (3♀♀); total 28♂♂, 24♀♀. Numerous immatures were preserved.

Other Texas Counties in which the writer has taken *tharos* are: Bastrop (20 May 62), Brazoria (15 Apr. 62), Caldwell (19 May & 7 July 62), Cameron (1 Apr. 60), Liberty (6 June 56), Panola (29 Sept. 62), San Jacinto (14 Apr. 62), San Patricio (21 Aug. & 10 Sept. 60, 24 Nov. 61) and Shelby (29 Sept. 62).

Phyciodes (Phyciodes) picta Edwards

Presidio County Texas, 11 June 1960. At a point on Texas Highway 170 near Alamita Creek, 6.5 miles southeast of Presidio, adults were found in good numbers feeding on the blossoms of *Heliotropium curassavicum* L. Several females were kept alive in hopes that eggs might be obtained and the immatures reared through. A search was then made for the reported larval foodplant, asters. None were to be found. As a temporary expedient a bit of *Heliotropium* was placed in the container with the females.

Two days later no eggs had been obtained. It then came to mind that *Siphonoglossa pilosella* (Nees) Torr., common in the area, might be the local larval foodplant. On the third day a few sprigs of *S. pilosella* were placed in the container with the females. The females began ovipositing within minutes after introducing this plant. The eggs were fertile. The larvae ate *S. pilosella* and matured in due course. The first larva pupated 8 July and the first adult emerged 13 July 1960. A fine series of adults were obtained and immature stages were preserved.

Adults were also taken in the wild 6 June 1960, Maverick County and 13 June 1960, Jeff Davis County Texas.

Phyciodes (*Phyciodes*) *phaon* Edwards

This species seems to be commonly distributed over all of the State. It has been taken every month of the year except December and January.

For a number of years it had been observed that various butterflies were attracted to the blossoms of *Phyla* (*Lippia*) *nodiflora* (L.) Greene. It was not until June 1960 that the writer determined the plant to be the well known larval foodplant of *P. phaon*. At this time a quantity of the plant was transferred from the wild to the laboratory garden. Here it grew well.

Bexar County Texas, 8 August 1960. Mrs. Kendall reported seeing what she thought was *P. phaon* visiting the the *Phyla* blossoms. The following afternoon we inspected the plant. After netting a female from a blossom, a closer examination of the plant disclosed six clusters of eggs on the underside of leaves near the ground. The captured female deposited a cluster of eggs on each of the following four days. Three more clusters were found on the plant 12 August. The day following this, a single larva was found in the wild about 12 miles from San Antonio. It was on the under surface of the leaf near the ground.

Ova from the captive female and from nature started hatching 10 August. The larvae were reared to maturity on *P. nodiflora*. The first larvae pupated 24 August and the first adults emerged 28 August 1960. On 6 September the last imago emerged for a total of 129. The early stages were preserved.

On 16 September 1960, about 11:15 AM CST, two females were seen at the *Phyla*. One was quite worn and feeding on blossoms. The other, much fresher, would alight first at one spot and then another with an obvious uncertainty of flight. After serveral of these erratic movements the insect chanced to alight on a leaf just above the ground. Without further ado deposited a large cluster of eggs beneath it. Examination of other leaves disclosed several more clusters. It was decided to leave these ova on the plant and observe them first hand in nature. Reexamina-

tion on 21 September disclosed only one cluster of eggs and no larvae. The remaining eggs showed signs of eminent hatching. The leaf was therefore marked and reexamined the following day, at which time the eggs were gone and no larvae could be found. Apparently some predator had come during the night and ate them. Eggs were found again 4 October. These were taken into the laboratory and under controlled conditions reared to maturity. These eggs hatched 8 October; adults started emerging 28 October 1960.

The writer has taken this species in 24 other Texas Counties; representative of all major areas of the State. The specific counties and dates of capture will therefore not be listed.

Phyciodes (*Tritanassa*) *texana* Edwards

On 30 October 1960 Mr. André Blanchard of Houston, Harris County, Texas wrote: "I have been hoping for two or three years to find the foodplant of *P. texana.* I have not been as lucky as you, but I feel very definitely that one more plant should be added to your list of four and that is *Dicliptera brachiata* (Pursh) Spreng. There is one place in Houston (Memorial Park) where *P. texana* is often seen in great numbers. There is a patch of *D. brachiata* right where *P. texana* is most abundant. I have raised all the eggs I could get on Shrimp Plant, but I have been unable to try them on *D. brachiata.*"

It was 26 November 1960 when Mr. and Mrs. Blanchard led Mrs. Kendall and the writer to the spot in Memorial Park. It was about midday. We entered a small opening in the wood and looked upon a little knoll bedecked with much defoliated *D. brachiata.* Several *P. texana* were slowly moving about. We had not been there five minutes when Mrs. Kendall observed a female *P. texana* oviposit on the upper leaves of this plant. The egg laying served to remove any doubt that *D. brachiata* is another larval foodplant for this species. Perhaps all genera of Acanthaceae are acceptable as larval foodplants to *P. texana.* The other known foodplants were recorded by Kendall (1959).

In Bexar County, *P. texana* has been taken every month of the year. It is least likely to be found in December and January. Additional field work may disclose that a few larvae overwinter.

The writer has taken adults in thirteen other Texas Counties as follows: Caldwell (19 May, 7 July 62), Cameron (3 Apr. 57, 19-21 Mar. 61, 22 Apr. 62), Comal (4 Mar 56, 9 Aug., 4 Sept. 59, 6 Aug. 60, 21 May 62), Goliad (25 Dec. 60, 25 Feb. 62), Gonzales (2 Mar. 57, 27 Apr. 62), Hidalgo (19-21 Mar. 61, 22 Nov. 62), Jeff Davis (10-13 June 60), Kerr (17 June 60), Medina (2 June 57), San Patricio (26 Nov. 61, 12 Apr. 62, 10 Nov. 62), Travis (2 Sept. 60), Uvalde (10 Mar. 62), Webb (5 June 60).

Anartia jatrophae luteipicta Fruhstorfer

Hidalgo County Texas, 23 October 1960. Adults were flying in good

numbers in sunny locations along wooded areas south of Mission. Several females were seen to oviposit on *Ruellia occidentalis* (Gray) Tharp & Barkley which was growing along road ditches. Two ovipositing females were kept for eggs but one soon died, probably due to injuries received when caught. The other one deposited a number of eggs, most of which were preserved. The young larvae commenced feeding soon after hatching. Six larvae pupated 17 November, others during the following week. Adults emerged 29 November (2♂♂, 2♀♀), 30 November (1♀), 1 December (1♂) and 2 December (1♂, 3♀♀). The life history was preserved. Additional research is required to determine the number of broods and diapause.

Phaeostrymon alcestis alcestis (Edwards)

The single brooded alcestis hairstreak may be found from about the last week in April to the first week of June depending upon the climatic conditions of its range.

Maverick County Texas, 6 June 1960. A long search extending over a period of six years for the immatures of this species ended on this date. The spot was a roadside park on U.S. Highway 277 between the villages of Normandy and Quemado. Dr. W. J Reinthal accompanied Mrs. Kendall and the writer. An *alcestis* was seen sitting on a branch of *Sapindus drummondii* Hook & Arn. In order to reach the insect it was necessary for the writer to jump. When the net came crashing down it contained two females *alcestis.* A quick search of the foliage disclosed a number of empty pupal cases. On the chance that this might be the larval foodplant for *alcestis* a small branch was cut from the tree and brought along for closer examination later. With a magnifying glass each leaf was examined and then the stems. Sure enough, in the axillae and leaf scars at the base of new growth, 28 unhatched and 16 hatched ova were found. The egg shells represented a prior season brood. During the following two years samplings of *S. drummondii* branches were made over a wide area including 14 Texas Counties and one in Kansas. The results of these samplings follow:

Bexar County Texas, 8 April 1961. At two locations a number of various instar larvae were found on trees with trunks about eight inches in diameter. A few larvae were found on seedlings beneath a larger tree at one of these locations. Recent high winds and heavy rains may have dislodged them from the larger tree. One of these locations was revisited 16 April; 26 more larvae and 1 pupa were found. Pupation occurred from 12-22 April. A total of 29 adults reared from these larvae emerged from 23-28 April. Twelve larvae and four pupae were preserved. At a third location 26 unhatched and 11 hatched ova were found 21 May 1961.

Caldwell County Texas, 19 May 1962. On FM 20 near the intersection of FM 1854, several adults were taken while feeding on blossoms of *Asclepias tuberosa* L. They were badly rubbed and damaged indicating the end of the flight period. Although S. *drummondii* is common in the area none was observed in the immediate vacinity.

Gonzales County Texas, 10 June 1961. At Palmetto State Park near Ottine, a few twigs from a fairly large (trunk about 10 inches diameter) S. *drummondii* tree yielded 24 unhatched and eight hatched eggs.

Jeff Davis County Texas, 9 June 1960. On Farm Road 1832 in Big Aguja Canyon, Davis Mountins, a sampling of twigs from a very large S. *drummondii* tree yielded many eggs. Eggs started hatching 9 April 1961. By 25 April 30 larvae had spun their girdles and three or four of these had pupated. Fifty-six adults emerged from 3-11 May. These were the subspecies *oslari* (Dyar) (determination by Harry K. Clench). Representatives of two complete life histories were preserved.

Kerr County Texas, 17 June 1960. At Kerrville State Park twigs of S. *drummondii* yielded 22 unhatched ova.

Kimble County Texas, 16 June 1960. On U.S. Highway 290 about one mile northwest of Texas Highway 27 intersection, a few twigs were taken from branches of S. *drummondii* overhanging the road. Seven unhatched eggs were found.

Live Oak County Texas, 24 November 1961. On Texas Highway 9 at La Parra Creek about 4.5 miles southeast of U.S. Highway 59 intersection, four eggs were found on S. *drummondii.* Only one small branch could be reached.

Mason County Texas, 14 August 1961. On U.S. Highway 87 a few miles southeast of Mason, a single S. *drummondii* tree was found growing beside the road. Its trunk was no more than four or five inches in diameter, but it was obviously a very old tree. One small branch was pulled down with the aid of my net and cut off. It yielded seven unhatched eggs, ten egg shells and a *Battus philenor* (L.) pupal skin.

Randall County Texas, 4 August 1961. In Palo Duro Canyon State Park a few twigs were cut from S. *drummondii.* Four eggs were found; they hatched 4 April 1962 but the larvae died.

San Patricio County Texas, 25 November 1961. At the Welder Wildlife Foundation Refuge, three hatched eggs were found on S. *drummondii* twigs. At the same location on 2 April 1962, 33 first and second instar larvae were found. The first of these larvae pupated 11 April. Adults emerged from 23-25 April. Most of these immatures were preserved.

Tarrant County Texas, 29-30 May 1961. Mr. Robert Stewart advised

me that he had taken four adults on S. *drummondii* near the Trinity River in Fort Worth. On 10 June he found one larva which later died. He also reported taking a large series of adults in the same area on 31 May 1962, but this time they were found around larger trees. I examined these specimens 22 September 1962.

Taylor County Texas, 13 August 1961. At Abilene State Park located on Farm Road 89 near Buffalo Gap, 12 unhatched eggs and five egg shells were found on S. *drummondii* twigs.

Travis County Texas, 5 September 1960. In Zilker Park at Austin, 17 eggs were found on twigs of a fairly large S. *drummondii* tree.

Sumner County Kansas. Stallings (1941) reported taking over 200 specimens during the period from middle of June to middle of July at two locations in a hedge row. On 11 November 1961 I wrote Mr. Stallings explaining where this butterfly lays its eggs and ask if he would sample the S. *drummondii* trees which I felt sure had to be in the hedge row. On 6 February 1962 he wrote: "Sunday afternoon Viola and I went out to see if we could find some *alcestis* eggs. It is still too muddy to get back to where the main colony is but we checked some trees along the roadside not too far away. After the second or third branch that I checked I found three eggs. Viola and I were all excited on how easy it was to find them and decided to gather you a bushel of eggs, more or less. So we spent the rest of the afternoon hunting and found two more eggs. So, it isn't as easy as it first sounded." The following weekend they found 24 more unhatched and five hatched ova which they sent to the writer. These eggs were stored on the shelf beside those from various other locations. Next time they were examined, twenty-one (21) had hatched and the larvae perished. This was long before the S. *drummondii* was ready to leaf out in the San Antonio area. The eggs had been subjected to freezing temperatures in Kansas; the much warmer temperature of Texas stimulated hatching.

Rearing Technique. Eggs were removed from twigs with a sharp knife. The twigs were held firmly on a table or other sturdy object, then by making a slight angled cut on either side of the egg it was removed on a "V" shaped chip. These chips were placed in small plastic containers bearing appropriate labels and stored in the garage. Periodic examinations were made to determine hatching. From about the middle of March on eggs were examined daily. Upon hatching, a small sprig of juvenile S. *drummondii* leaves was placed in the container. The newly hatched larvae would climb upon it and start feeding. Each day a fresh sprig was substituted for the old one. The latter was then placed in a large container with a larger twig of foodplant. If closed jars are employed, care must be used to assure that the jar does not become over

crowded either with larvae or foodplant. When fully mature, larvae begin to loose their color and move about. This is the time to move them to another container for pupation.

BIOLOGY. Based on immature stages, typical *alcestis* does not differ from the subspecies *oslari.* The egg laying habits are identical and the larval foodplant is the same. Chinaberry (*Melia*) of the MELIACEAE (Mahogany family) has been reported in literature as the larval foodplant. *Melia azedarch* L. was repeatedly offered larvae in the laboratory and they refused it. *S. drummondii* belongs to the SAPINDACEAE (Soapberry family). Locally this plant is known as wild or western chinaberry which may account for the use of *Melia* in the literature. Eggs are deposited on the twigs of large trees or very old small ones; never on small seedlings.

Satyrium calanus falacer (Godart)

Medina County Texas, 24 April 1960. On the R. A. Haby Ranch adjacent to Medina Lake, the author searched under rocks, logs and debris for last instar larvae of *Nymphalis antiopa lintnerii* (Fitch). In addition to five *lintnerii* larvae, one *S. falacer* pupa was found. This pupa was under an old log secured to the bark. A variety of trees and shrubs grow at this spot including walnut; the one on which the larva most likely fed. A female emerged 6 May 1960.

Bexar County Texas, 23 April 1961. A few miles south of San Antonio near the Atascosa County line, hickory, *Carya texana* Buckl. grows in fairly large patches. This is the sandy area of the County. While scratching among fallen leaves beneath one of these trees a pupa of *S. falacer* was found. There is good reason to suspect the larva fed on hickory because this is the only species of tree growing within 100 yards of the spot. A male emerged 3 May 1961.

Kendall County Texas, 23 April 1961. Mrs. A. M. Montgomery gave me two last instar larvae which she found on *Juglans microcarpa* Berl. growing on the bank of the Guadalupe River at Comfort. One of the larvae appeared sickly; it was preserved. The other was reared through on *J. microcarpa.* A female emerged 12 May 1961.

The author has also collected adults of this species in the following Texas Counties: Bastrop (Bastrop State Park) 20 May 1962; badly worn. Caldwell (Farm Road 20 near intersection of Farm Road 1854) 19 May 1962; feeding on blossoms of *Asclepias tuberosa* L., badly worn. Comal (Guadalupe River, few miles west of New Braunfels) 15 May 1960; 1 ♂, fairly fresh. Further rearings of this species will disclose the best time and places to collect it in nature.

Callophrys (*Incisalia*) *henrici solatus* (Cook & Watson)

Bexar County Texas, 17 February 1962. At a spot just north of San Antonio, *solatus* was found flying in fair numbers. This was the fourth consecutive season it had been taken near the city and we still didn't

know its larval foodplant. None of the foodplants reported for *henrici* (*Prunus, Vaccinium, Gaylussacia* and *Cercis*) seemed to hold for *solatus*. In an all out effort to solve this problem, a bit of logic and process of elimination were employed. A mental note had been made of the various botanical specimens found at each of seven locations where *solatus* had been taken previously. These were now written down and it became apparent that persimmon, *Diospyros texana* Scheele, was the one plant common to all locations. *D. texana* not *D. virginiana* L. of eastern Texas, is the smooth-barked shrub so common in the Edwards Plateau area.

Mrs. Kendall and I revisited the spot on the following day, this time to concentrate our attention around persimmon trees. We arrived at the location about 10:45 AM CST. Some 50 feet away was a nice persimmon tree partially exposed to the morning sun. Before I could get my collecting things from the car. Mrs. Kendall announced that a female had just been seen ovipositing on persimmon buds. We continued to observe the activity around this shrub and saw two more females deposit eggs. Then a male came along, established a control point on an upper branch and proceeded to patrol the area. Everything that came within three or four feet was driven away. While we watched, he chased off a *Battus philenor, Papilio asterius, Colias cesonia, Colias philodice, Strymon melinus,* several honeybees and a large redish-brown wasp. It was about 11:15 AM when the *solatus* activity around this and other nearby trees suddenly stopped. It occurred to us that perhaps *solatus* had gone off to feed. We checked some flowering *Forestiera pubescens* Nutt. about sixty feet away and took seventeen and could have taken as many more. Three females were kept alive for eggs. A few females had begun to return to the persimmon about 1:20 PM at which time we departed.

During the period 19 February – 20 March more than 300 eggs were deposited by the three females on buds of *D. texana*. They refused to oviposit on leaves. One egg collected in nature 18 February hatched 21 February. The other ova hatched about four days after they were deposited. Larvae readily ate the juvenile leaves of this plant. They will also eat the fruits but not the older leaves. From 16 March to 17 April about 90 larvae pupated. The early stages were preserved and pupae were also provided for chromosome counts. Adults emerged from pupal diapause the following year. Two males emerged prematurely on or about 20 January; others emerged: 15 Feb. (1♀), 3 Mar. (1♂), 4 Mar. (2♂♂), 5 Mar. (5♂♂, 2♀♀), 6 Mar. (1♀), 7 Mar. (2♂♂, 1♀), 8 Mar. (1♂, 3♀♀), 9 Mar. (2♂♂, 3♀♀), 10 Mar. (3♂♂, 3♀♀), 11 Mar. (2♂♂, 3♀♀), 12 Mar. (1♂, 2♀♀), 13 Mar. (1♂, 4♀♀), 14 Mar. (1♀), 15 Mar.

(1♂), 16 Mar. (1♂), 17 Mar. (2♂♂), 18 Mar. (♂), 19 Mar. (1♀). Sixteen pupae died.

In Bexar County this species has been taken as early as 7 February; the latest date is 4 April. It has also been collected in Comal County (4 Mar. 56) and Uvalde County (10 Mar. 62).

Euristrymon ontario autolycus (Edwards)

Bexar County Texas, 8 April 1961. Near San Antonio two larvae were found on *Quercus virginiana* Mill. One died, the other pupated in due course and a male emerged 22 April. Still another larva found 16 April, fed for a few days then pupated; a male emerged 29 April 1961.

Kerr County Texas, 7-8 May 1960. At Kerrville State Park, adults were found very common. Three hundred ninety specimens were collected on blossoms of *Asclepias decumbens* (Nutt.) Shinners. Adults were also common around oak trees in the park. Several, freshly emerged, were still hanging from blades of grass beneath the oaks. Scratching among fallen leaves under one large *Q. virginiana* yielded two pupae. One was dead; from the other a female emerged 13 May. Also, a female taken *in copula* deposited 78 ova during the period 9-12 May on twigs of *Q. virginiana*. Eggs were kept at fairly constant temperature in the laboratory and they failed to hatch the following year.

San Patricio County Texas, 1 April 1962. At the Welder Wildlife Foundation Refuge, four larvae and one pupa were found on *Q. virginiana*. One larva had spun-up in the bark but a predator had killed it before pupation. The pupa also proved to be the victim of a predator. Closer examination disclosed one of the larvae to be *Strymon melinus*. The remaining two larvae pupated in due course and two males emerged 15 April. At the same location another pupa was found 12 April which produced a female 15 April. Three days later adults were seen flying about the upper branches of oaks.

At a roadside park on Farm Road 632 near Ingleside, 6 April 1962, 26 larvae were found on *Q. virginiana* and *Q. laurifolia* Michx. Numerous larvae of several other lepidopterous species were found on the oaks: *Catocala* (several spp.), *Hemerocampa leucostigma* Smith, *Safia amella* Guenée, *Malacosoma disstria* Hübner. A return visit 10 April found the trees almost completely defoliated and the *E. autolycus* larvae moving about in search of food. Twenty-five more larvae were collected. The first seven larvae pupated 10 April. The first adults (3♂♂, 2♀♀) emerged 20 April; the last one, 5 May. A good series of immatures was preserved and live pupae provided for chromosome counts.

The writer has collected this species in five other Texas counties as follows: Comal, 11 May 58, 15 & 22 May 60; Caldwell, 19 May 62; Gonzales, 27 Apr. 62; Kendall, 7 & 8 May 60; and Uvalde, 4 May 61.

Strymon melinus franki Field

In Texas *franki* is more common than typical *melinus*. The writer has collected it each month of the year except December and January, in 37 counties representing every major botanical area of the State.

Bastrop County Texas, 2 September 1961. At a roadside park on Texas Highway 21 about 5.5 miles northeast of Bastrop, two last instar larvae were found eating the immature seeds of *Lespedeza hirta* (L.) Hornem. One larva proved to be parasitized. The other pupated 8 September and a male emerged 17 September. Also, in Bastrop State Park 4 September, two more parasitized larvae were found on this plant.

Bexar County Texas, April 1956. A larva found feeding on the blossom buds of *Lupinus texensis* Hook matured in due course and a male emerged but the exact date was not recorded. Six second instar larvae were found 20 August 1957 on blossom buds of *Phaseolus vulgaris* L. All were lost due to fungus. A female was observed 20 April 1958 to oviposit on blossom buds of wine cups, *Callirhoe leiocarpa* Martin growing in the laboratory garden. More eggs were obtained from the captive female but once again all larvae were lost due to fungus. A number of larvae found 3 May 1958 feeding on *L. texensis* buds produced adults but emergence dates were not recorded. A female was observed to oviposit 19 June 1960 on blossom buds of *Lantana macropoda* Torr. Careful examination disclosed a first instar larva feeding on the buds of this plant. This larva, reared to maturity on *L. macropoda* buds, produced a female 9 July 1960. Another larva found on this plant 6 July 1960 proved to be parasitized. Again in the laboratory garden, a female was seen ovipositing 10 July 1960 on blossom buds of althea, *Hibiscus syriacus* L. A week later one was seen to oviposit on *Croton monanthogynus* Michx. On 4 March 1961 a female was observed ovipositing on blossom buds of *L. texensis*. A larva found 21 February 1962 feeding on juvenile leaves of *Diospyros texana* Scheele; pupated 11 March and a male emerged 19 March 1962. A last instar larva found 1 August 1962 on blossom buds of *Tecoma stans* (L.) Juss. pupated 4 August but was parasitized; an Ichneumonid emerged 21 August 1962.

Gonzales County Texas, 15 August 1959. On U.S. Highway 183 not far from Palmetto State Park, a female was observed to oviposit on blossom buds of *Cassia puberula* (Greene) Macbride.

Kerr County Texas, 18 July 1959. At Kerrville State Park a female was observed ovipositing on blossom buds of *Indigofera texana* (Buckley) Turner. In the laboratory, it deposited more than a dozen eggs on this plant. Eggs started hatching 21 July. Larvae readily ate buds of *I. texana*. On 24 July they were offered *P. vulgaris* buds which they also ate. Fungus killed all but two of the larvae and these were offered *Passiflora*

incarnata L. blossom buds 29 July which they accepted. One more larva died of fungus 5 August. The remaining larva pupated 10 August and a female emerged 19 August 1959. Still another larva found 30 June 1962 on *I. texana* pupated 6 July with a male emerging 13 July 1962.

San Patricio County Texas, 1 April 1962. At the Welder Wildlife Foundation Refuge a larva was found feeding on juvenile leaves of *Quercus virginiana* Mill. It was among *Euristrymon o. autolycus* larvae found on the same tree. It pupated 6 April and a female emerged 17 April 1962. Also at the Refuge, while gathering *Erynnis funeralis* larvae 24 April on *Sesbania drummondii* (Rydb.) Cory, four *franki* larvae were found eating the juvenile leaves of this plant. One larva was killed accidentally; the remaining three pupated 30 April, 3 & 4 May, and the adults emerged 9 May (♂), 13 May (♀) and 14 May 1962 (♂).

Val Verde County Texas, 1 May 1961. On U.S. Highway 90 near the Devil's River, one larva was found eating the immature seed pods of *Porlieria angustifolia* (Engelm.) Gray. It produced a female 15 May 1961.

Careful attention has not been given to the rearing of this species because it is so common. It is significant to note however, that *franki* not only feeds on blossom buds and immature fruits but also on juvenile leaves of certain plants. Fifteen larval foodplants representing eight botanical families are recorded in this paper. Of these, *franki* will eat the juvenile leaves of three. Undoubtedly the juvenile leaves of many other plants are acceptable to *melinus* and *franki*. Although larvae were not reared through on each of these 15 plants, there is little doubt that *franki* larvae find them acceptable. These 15 plants are as follows. FAGACEAE: *Quercus virginiana;* LEGUMINOSAE: *Lespedeza hirta, Lupinus texensis, Phaseolus vulgaris, Tecoma stans, Cassia puberula, Indigofera texana, Sesbania drummondii;* ZYGOPHYLLACEAE: *Porlieria angustifolia;* EUPHORBIACEAE: *Croton monanthogynus;* MALVACEAE:*Callirhoe leiocarpa, Hibiscus syriacus;* PASSIFLORACEAE: *Passiflora incarnata;* EBENACEAE: *Diospyros texana;* VERBENACEAE: *Lantana macropoda.*

Strymon laceyi (Barnes & McDunnough)

San Patricio County Texas, 22 April 1961. At Lake Carpus Christi State Park on the Nueces River near Mathis, one fresh male was taken. Another specimen was seen within a few feet of the first but it escaped capture. It was not until July 19, when H. A. Freeman made the determination, that I knew the real significance of this catch; otherwise, more time would have been devoted to searching the spot for additional specimens.

While this species is not on the reared list, it seems appropriate that a note should be included in this paper recording the capture. All of the four known specimens in collections are from Texas; this is the only male. H. A. Freeman has two females which he collected in Hidalgo County; one on 24 October 1944 and the other 14 December 1946. The holotype female was collected at or near Del Rio in Val Verde County 9 July 1909.

Hemiargus isola isola (Reakirt)

The first known larval foodplant for *isola* was recorded from Taylor County Texas by Remington (1952). He found one larva feeding on a seed pod of mesquite, *Prosopis juliflora* (Swartz) DC. Kendall (1959) recorded the buds and blossoms of *Indigofera miniata* Ortega var. *leptosepala* Nutt. Since then, six other larval foodplants have been discovered and they are given here.

Bexar County Texas, 30 April 1960. Two females were taken ovipositing on the blossom buds of sour clover, *Melilotus indicus* (L.) All. Additional ova were deposited in the laboratory. *M. indicus* was not readily available so the eggs were placed on potted *Dalea pogonanthera* Gray and placed inside a large screened cage outdoors. The eggs soon hatched but the larvae disappeared. On 18 June 1960, two ova were found on the blossom buds of *Albizia julibrissin* Durazz. growing in the laboratory garden. The small branch was sleeved. Pupae were found in the sleeve, 4 & 9 July; a female emerged 10 July from one, the other had succumbed to a predator. Four other imagos whose larvae fed on the buds of this plant, emerged 23 & 29 July, 3 August 1960 and 31 May 1961. A female was observed ovipositing on the buds of this plant 27 May 1961; the eggs were not collected. On 1 & 2 July 1961 adults were found swarming around the blossoms of *Acacia hirta* (Nutt.) Robinson. A female taken at this time refused to oviposit. On 4 July however, while examining the cage, a larva was found crawling on the screen cover. Assuming that it had parted company with the withered twig below, fresh *A. hirta* buds were offered and found acceptable. The larva pupated 13 July and a male emerged 19 July 1961. A female was seen to oviposit on the buds of this plant 16 July. Closer examination disclosed a last instar larva feeding on the buds. It was taken into the laboratory where it pupated 20 July and a female emerged 26 July 1961. Again on 27 May 1962 *isola* was found swarming around *A. hirta* and soon a female was seen to oviposit on the blossom buds. Also at this time, two larvae on the plant were found to be attended by ants, and a pair of adults were taken *in copula*. The larvae pupated in due course; a male emerged 2 June and a female 5 June 1962. Another larva found 17 June 1962 was feeding on the juvenile leaves of *Acacia roemeriana* Scheele;

it pupated 29 June and a female emerged 6 July 1962.

Caldwell County Texas, 21 May 1962. One larva found on *A. hirta* pupated 27 May and a male emerged 3 June 1962.

Kerr County Texas, 20 June 1962. At Hays Memorial Park in Kerrville, adults were found feeding on the blossoms of *Melitotus indicus* and *Indigofera lindheimeriana* Scheele. Examination of the last named plant yielded two larvae; they pupated 3 & 4 July and adults emerged 9 & 10 July 1962. At the same location and date, two other larvae were found on *I. leptosepala,* one of which proved to be parasitized. The other pupated 5 July and a female emerged 11 July 1962.

Medina County Texas, 24 April 1960. In a ravine adjacent to Medina Lake, two females were observed ovipositing on the buds of *D. pogonanthera* var. *walkerae* (Tharp. & Barkley) Turner. After depositing an egg among the buds, the female would fly to another plant exposed to the midday sun and repeat the process. Although larvae were not reared through on this plant, it is not likely that two females would repeatedly choose a wrong larval foodplant. It is believed that further research will show *isola* larvae feed on the buds, fruits and juvenile leaves of a wide variety of plants.

The writer has taken imagos in 28 other Texas Counties as follows: Aransas (20 Aug. 60), Atascosa (31 Mar. 57), Bandera (2 Apr. 59), Bastrop (19-20 May 62), Brewster (7 June 60), Cameron (21-22 Apr. 62), Coke (3 Aug. 61), Comal (8 Nov. 59, 21 May 62), Crocket (16 June 60), Culberson (14 June 60), Dimmit (6 June 60), El Paso (15 June 60), Gonzales (7 July & 25 Aug. 62), Guadalupe (7 July & 26 Aug. 62), Hidalgo (3 Apr. 57, 20 Mar. 61, 23 Apr. & 22 Nov. 62), Jeff Davis (10-13 June 60), Kimble (16 June 60), Kleberg (22 Mar. 61, 17 Apr. 62), Maverick (6 June 60), Nueces (11 Apr. & 1 Sept. 62), Pecos (16 June 60), Presidio (11 June 60). Reeves (9 & 15 June 60), San Patricio (10-11 Sept. 60), Travis (2 & 5 Sept. 60), Uvalde (30 Apr. 61), Val Verde (7 June 60, 30 Apr. 61) and Webb (5 June 60).

Hemiargus ceraunus zacheina (Butler & Druce)

Bexar County Texas, 15 August 1961. Two larvae were found on *Acacia angustissima* (Mill.) Kuntze var. *hirta* (Nutt. *ex* Torr. & Gray) Robinson which had recently been planted in the flower garden. This is the small thornless *Acacia* which reaches a height of about two feet and forms small colonies. One of these larvae was parasitized, the other pupated 18 August and a male emerged 25 August. A female was taken 10 September 1961 and confined in a small jar with a sprig of juvenile *A. hirta* leaves. During the period 10-21 September, 98 ova were deposited. The female died 22 September. Eggs started hatching 13 September. Larvae accepted the juvenile leaves. Twelve larvae pupated between 1-14 October. Adults emerged from 10-23 October 1961. The early stages were preserved. There were heavy losses among the larvae. These losses were later attributed to the presence of two aphis eating Dipterous larvae, family Syrphidae,

which were found in the rearing container. It is believed that many of the *zacheina* larvae fell prey to these predators. On 24 September 1961 a female was seen ovipositing on *A. hirta;* time, about 11:45 AM CST.

On 9 September 1962, a female was observed to feed on the blossoms of *Rhyncosia minima* (L.) DC and then deposit an egg on a blossom bud of the same plant. Examination disclosed still another egg. A net was not at hand to catch the female, but the two eggs were brought into the laboratory where they later hatched. The larvae accpeted the blossom buds of *R. minima* but they were soon to die from fungus.

The writer has found *zacheina* very common in areas where neither *A. hirta* nor *R. minima* were present. It is therefore believed that the buds and juvenile leaves of a variety of legumes may be acceptable to larvae of this species.

Other Texas Counties in which *zacheina* has been taken are: Atascosa (12 Nov. 62), Bee (3 Sept. 62), Hidalgo (3 Apr. 57 & 22-23 Nov. 62), Lee (30 Sept. 62), Live Oak (26 Nov. 61 & 10-12 Nov. 62), Nueces (1 Sept., 10 & 24 Nov. 62), San Patricio (10-11 Sept. 60, 7-8 Oct., 24-26 Nov. 61, 2 Sept., 10-11 & 21-24 Nov. 62).

CHART OF LARVAL FOODPLANTS

Family	Species	Lepidoptera
Acanthaceae	*Dicliptera brachiata*	*Phyciodes texana*
	Ruellia occidentalis	*Anartia j. luteipicta*
	Siphonoglossa pilosella	*Dymasia dymas*
		Phyciodes picta
Annonaceae	*Asimina parviflora*	*Graphium marcellus*
Aristolochiaceae	*Aristolochia elegans*	*Battus p. lucayus*
		?*Battus philenor*
	Aristolochia longiflora	*Battus p. lucayus*
		Battus philenor
Compositae	*Aster prealtus*	*Phyciodes tharos*
	Helianthus annuus	*Chlosyne g. carlota*
Ebenaceae	*Diospyros texana*	*Callophrys h. solatus*
		Strymon m. franki
Euphorbiaceae	*Croton monanthogynus*	*Strymon m. franki*
Fagaceae	*Quercus laurifolia*	*Euristrymon o. autolycus*
	Quercus virginiana	*Euristrymon o. autolycus*
		Strymon m. franki
Gramineae	*Axonopus compressus*	*Euptychia h. sosybius*
	Cynodon dactylon	*Euptychia g. freemani*
		?*Euptychia dorothea*
	Stenotaphrum secundatum	*Euptychia cymela*
		Euptychia h. sosybius

CHART OF LARVAL FOODPLANTS

Family	Species	Lepidoptera
Juglandaceae	*Carya texana*	*?Satyrium c. falacer*
	Juglans microcarpa	*Satyrium c. falacer*
Leguminosae	*Acacia hirta*	*Hemiargus c. zacheina*
		Hemiargus isola
	Acacia roemeriana	*Hemiargus isola*
	Albizia julibrissin	*Hemiargus isola*
	Cassia puberula	*Strymon m. franki*
	Dalea walkerae	*Hemiargus isola*
	Indigofera leptosepala	*Hemiargus isola*
	Indigofera lindheimeriana	*Hemiargus isola*
	Indigofera texana	*Strymon m. franki*
	Lespedeza hirta	*Strymon m. franki*
	Lupinus texensis	*Strymon m. franki*
	Melilotus indicus	*Hemiarus isola*
	Phaseolus vulgaris	*Strymon m. franki*
	Prosopis juliflora	*Hemiargus isola*
	Rhyncosia minima	*Hemiargus c. zacheina*
	Sesbania drummondii	*Strymon m. franki*
Lauraceae	*Lindera pubescens*	*Papilio t. ilioneus*
	Persea borbonia	*Papilio palamedes*
		Papilio t. ilioneus
	Sassafras albidum	*Papilio t. ilioneus*
Malvaceae	*Callirhoe leiocarpa*	*Strymon m. franki*
	Hibiscus syriacus	*Strymon m. franki*
Oleaceae	*Fraxinus subintegerrima*	*Papilio multicaudata*
Passifloraceae	*Passiflora incarnata*	*Strymon m. franki*
Rutaceae	*Ptelea trifoliata*	*Papilio cresphontes*
	Ruta graveolens	*Papilio cresphontes*
		Papilio p. asterius
	Thamnosma texana	*Papilio p. asterius*
	Zanthoxylum clava- herculis	*Papilio cresphontes*
	Zanthoxylum fagara	*Papilio cresphontes*
Sapindaceae	*Sapindus drummondii*	*Phaeostrymon a. alcestis*
		Phaeostrymon a. oslari
Umbelliferae	*Anethum graveolens*	*Papilio p. asterius*
	Daucus carota	*Papilio p. asterius*
	Daucus pusillus	*Papilio p. asterius*
Verbenaceae	*Lantana macropoda*	*Strymon m. franki*
	Phyla nodiflora	*Phyciodes phaon*
Zygophylliaceae	*Porlieria angustifolia*	*Strymon m. franki*

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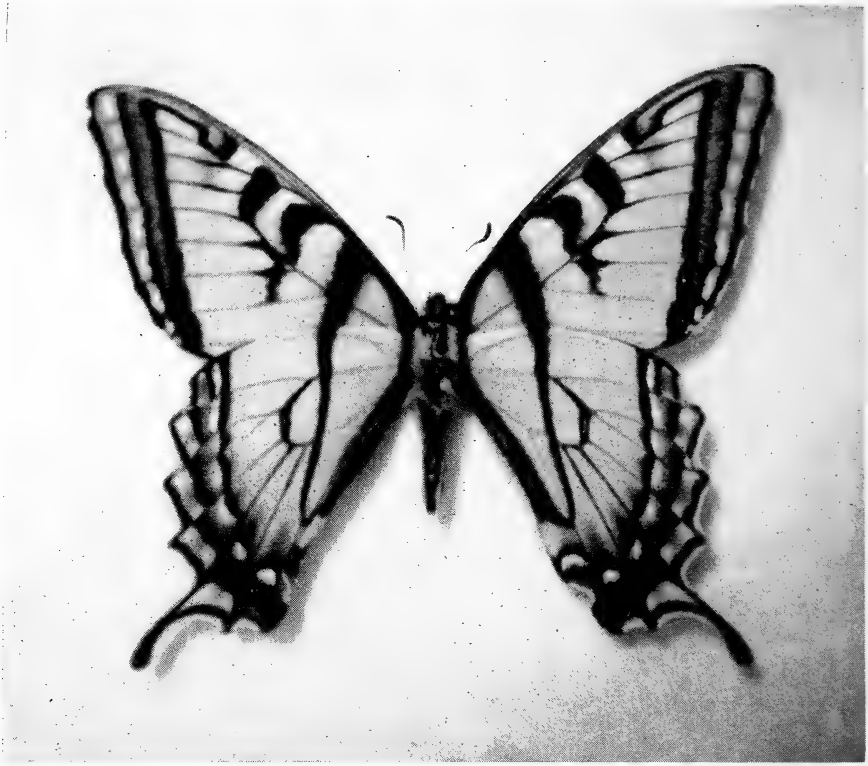
VENATION ABERRATION IN PAPILIO GLAUCUS

In June of 1961 on a dirt road in the woods near Weston, Vermont, I came across a flight of *Papilio glaucus canadensis* Rothschild & Jordan, and in a several day period took nearly two hundred. They were all fresh males, flying southeast, single file about five feet from the ground along the sunny side of the road. The flight was most dense during the late morning hours, when the individuals were flying by at the rate of six to seven a minute.

Returning to the same spot in 1962 the same phenomenon was discovered being repeated. It was on June 8, 1962 during one of these flights that a specimen was captured with the following venational aberration. Vein M_1 on each of the hind wings, rather than continuing singly to the margin, divides and bows into an oval coming back together to form



EXPLANATION OF PLATE

Papilio glaucus canadensis Rothschild & Jordan, ♂, undersurface, showing the aberration in vein M_1 in both hind wings.

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a single vein again just before reaching the margin. The symmetry is not exact however, since the division on the left wing begins at the cell and continues to within 2 mm of the margin; whereas on the right wing the oval is much shorter with the vein being normal for 2 mm next to the cell and for 3 mm on the margin.

Though many small variations in markings were found in specimens in the flight, this is the only specimen in which there was an outstanding aberration in the venation.

I might add that on repeated returns to the location in 1963, it was found that the flight was totally lacking, only four to five specimens being seen.

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BUTTERFLIES ATTRACTED TO LIGHT IN GUJARAT STATE, INDIA

by Ernest M. Shull

Ahwa, via Bilimora, Dangs Dist., Gujarat State, INDIA

During the southwest monsoon (mid-June through October, 1963) the writer has collected over four thousand insects at lights. The great majority of these insects (Heterocera) were collected at a 400-watt mercury-vapor lamp located in the Gujarat State Transport bus compound at Ahwa, headquarters of the Dangs District. The fluorescent lights placed on the walls of the transport office building also provide excellent collecting places. Likewise the petromax lights (pressure lamps) used in the mission bungalow attract many insects.

Ahwa is located on a plateau (alt. 1700 ft.) and is surrounded by teak and bamboo jungle. The average annual rainfall is eighty inches. In this pan-tropical area there are many species of moths, butterflies and other insects attracted to light. This paper, however, will deal only with the butterflies attracted to light during the monson season and with a few scattered records throughout the year.

There are no electric lights in the town of Ahwa. Only on the dark nights (nights without moonlight) are the kerosene street lamps lighted. Even then very few insects are to be found at these lesser lights, for the powerful mercury-vapor light provides a greater attraction. This lamp is mounted near the top of a twenty-five foot steel pole, so that the whole bus compound and even nearby areas are lighted by its powerful rays.

In 1963 the writer has taken seventeen species of Rhopalocera at light in India, as follows:

Satyridae

1. *Mycalesis perseus* (Fabricius). Oct. 19, 1963, Ahwa, the dry season form was taken at 10:00 p.m. at the fluorescent light in the transport office building (see No. 11, in photo).

2. *Mycalesis mineus* (Linnaeus). Sept. 30, 1963, Ahwa, 10:30 p.m. at the mercury-vapor lamp in the bus compound (see No. 7, in photo); another was taken on Aug. 20, 1963, Ahwa, 9:45 p.m. at the fluorescent light in the transport building (see No. 8, underside, in photo); both of these are wet season forms. The dry season form was taken on Oct. 19, 1963, Ahwa, at 9:45 p.m. below the flourescent light (See no. 9, underside in photo; the ocelli are reduced to white specks).

3. *Ypthima baldus* Fabricius. Sept. 29, 1963, Ahwa, 10:15 p.m. at the mercury-vapor lamp, the only record of this species at light (see no. 10, underside, in photo).

4. *Melanitis leda* (Drury). First record of the wet season form

"determinata" at the mercury light was at 9:45 p.m. on July 26, 1963, I have many subsequent records of this form throughout the 1963 monsoon season. The dry season form "ismene" was first taken on Oct. 24, 1963, 9:30 p.m. at the mercury-vapor lamp (See No. 2 in photo), another on Nov. 6, 1963 at 9:30 p.m. at the same light, and again on Nov. 12, 1963 two were collected by the petromax lamp in the mission bungalow, Ahwa, at 6:30 p.m. and at 9:15 p.m. Both forms frequently appear at the mercury-vapor lamp and at the fluorescent lights; however, the wet season form seems to be more common at light, occasionally appearing in great numbers, twenty or thirty at one time.

5. *Lethe rohria nilgiriensis* Guérin. Oct. 30, 1963, Ahwa, one ♂ was taken at 8:15 p.m. at the fluorescent light in the transport building (see No. 19 in photo).

NYMPHALIDAE

6. *Euthalia garuda* (Moore). Oct. 19, 1963, Ahwa, 10:15 p.m., one ♀ was taken at the fluorescent light in the transport building (see No. 1 in photo); on Nov. 9, 1963 a ♂ was caught at a petromax light at 7:15 p.m. in the mission bungalow.

7. *Precis hierta hierta* (Fabricius). Feb. 17, 1963, 9:00 p.m., one ♀ was taken at a petromax lamp in the mission bungalow, the only record of this species at light (see No. 16 in photo).

8. *Vanessa cardui* (Linnaeus). Sept. 25, 1963, Ahwa, 9:30 p.m. at fluorescent light in the transport building, the only record at light (see No. 18 in photo).

9. *Ergolis merione merione* (Cramer). Oct. 18, 1963, Ahwa, 9:15 p.m. at fluorescent light in transport building, the only record at light (see No. 14 in photo).

LYCAENIDAE

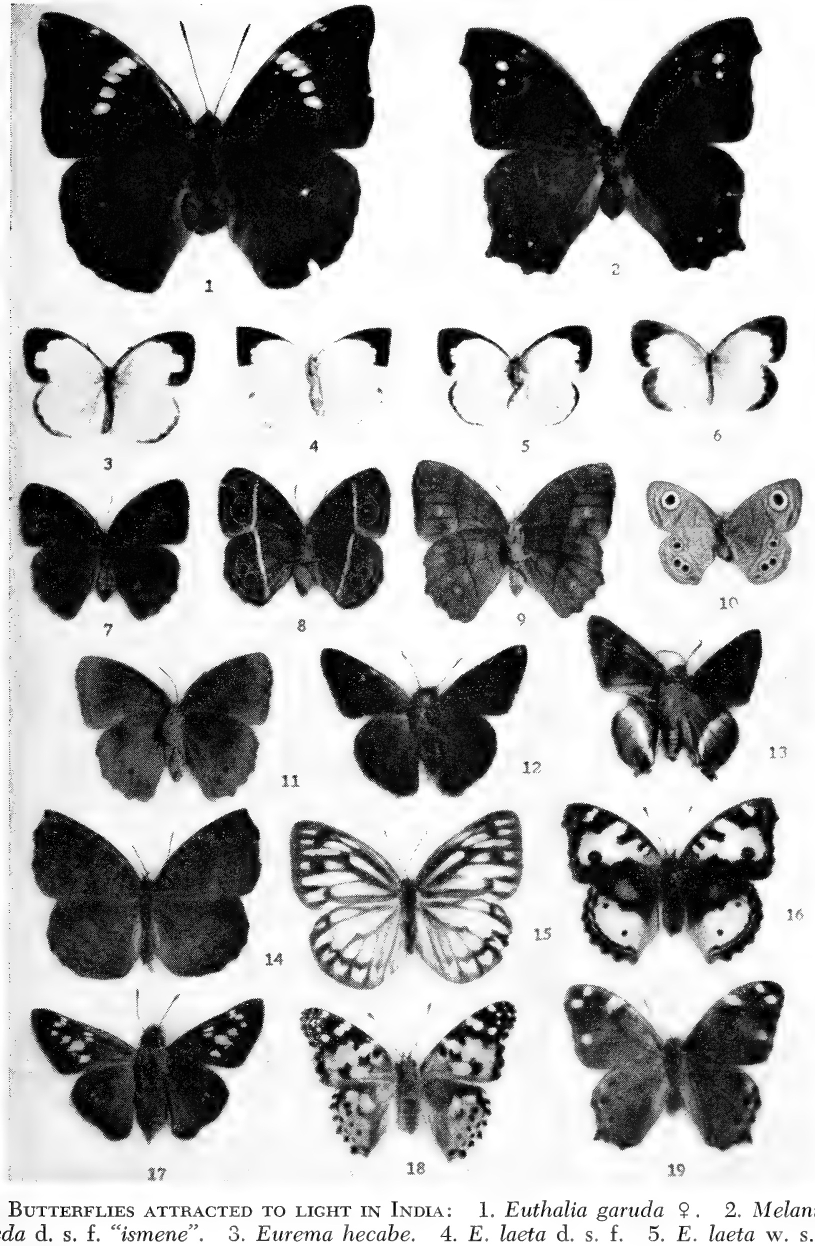
10. *Zizeeria lysimon* Hübner. Nov. 11, 1963, Ahwa, a ♂ was captured at 8:30 p.m. at the fluorescent light in the transport building, the only record at light.

PIERIDAE

11 *Huphina nerissa* (Fabricius). Sept. 28, 1963, Ahwa, 8:30 p.m., a ♀ was taken at the fluorescent light in the transport building, the only record at light (see No. 15 in photo).

12. *Eurema brigitta* (Cramer). Sept. 16, 1963,Ahwa, 10:15 p.m., one was taken at the mercury-vapor lamp (see No. 6 in photo); another was captured on Oct. 25, 1963 at 9:30 p.m. at the fluorescent light in the bus transport building.

13. *Eurema hecobe* (Linnaeus). July 11, 1963, Ahwa, 10:15 p.m., one was taken at the mercury-vapor lamp (see No. 3 in photo); this species has been taken many times at the mercury lamp and at the



Butterflies attracted to light in India: 1. *Euthalia garuda* ♀. 2. *Melanitis leda* d. s. f. "*ismene*". 3. *Eurema hecabe*. 4. *E. laeta* d. s. f. 5. *E. laeta* w. s. f. "venata". 6. *E. brigitta*. 7. *Mycalesis mineus* w. s. f., upperside. 8. *M. mineus* w. s. f., underside. 9. *M. mineus* d. s. f., underside. 10. *Ypthima baldus*, underside. 11. *Mycalesis perseus* d. s. f., underside. 12. *Hasora chromus*, ♂ upperside. 13. *H. chromus*, ♂ underside. 14. *Ergolis merione merione*. 15. *Huphina nerissa* ♀. 16. *Precis hierta hierta* ♀. 17. *Pelopidas conjuncta*. 18. *Vanessa cardui*. 19. *Lethe rohria nilgiriensis* ♂.

fluorescent lights during the monsoon months.

14. *Eurema laeta* Boisduval. Aug. 1, 1963, Ahwa, 9:45 p.m., one wet season form "venata" was taken at the mercury-vapor light (see No. 5 in photo), on Oct. 24, 1963, 10:15 p.m., the dry season form "laeta" was taken at the fluorescent light in the transport building (see No. 4 in photo).

15. *Catopsilia crocale* (Cramer). Oct. 27, 1963, Ahwa, 9:10 p.m., a badly faded ♀ was captured at the fluorescent light in the transport building.

HESPERIIDAE

16. *Hasora chromus* (Cramer). Aug. 16, 1963, Ahwa, 8:00 p.m., a ♂ was taken at the mercury-vapor lamp in the bus compound (see No. 12, in photo); another was captured on Sept. 16, 1963 at 6:55 p.m. while flying around a petromax light in the mission bungalow (see No. 13, in photo).

17. *Pelopidas conjuncta* Hewitson. Sept. 20, 1963, Ahwa, 9:30 p.m., one was taken at the fluorescent light in the transport building, the only record at light (see No. 17 in photo).

OBSERVATIONS AND SUMMARY

The literature on the butterflies of India records only a few species as crepuscular or as nocturnal. Like Donahue (1962), the present writer has found *Melanitis leda* to be the most common single species at light. The wet season form "determinata" has been taken on sixty nights at light and the dry season form "ismene" many times. Some of the satyrids are somewhat crepuscular, especially *Mycalesis mineus* and *M. perseus,* the former having been taken at light more than a dozen times and the latter on several occasions. Several species of the genus *Eurema* (Pieridae) fly at dusk. *Eurema hecabe* probably should be listed as a crepuscular species. The writer has twenty records of *hecabe* at the mercury-vapor lamp and at the fluorescent lights. Likewise *Eurema laeta* and *E. brigitta* are somewhat crepuscular and occasionally found at light. Of the Hesperiidae, *Hasora chromus* was frequently observed at the mercury-vapor lamp during the 1961 southwest monsoon season Shull, 1963). In 1963, however, it has been taken at light on two occasions only. Large numbers of the skippers are crepuscular in their habits, so it may not be surprising to find a few skippers attracted to light; however, *Matapa aria* (Moore) (Hesperiidae) flies at dusk feeding on *Lantana* nectar just outside the writer's office door, but it has never been attracted to the petromax light burning only twenty-five feet away. Likewise *Abisara echerius* (Stoll) (Erycinidae) frequently flies at dusk, even flying around on the veranda just outside the office, but it too shows no attraction to the light. Thus it would be wise to avoid the conclusion

that crepuscular species are more likely to be attracted to light than are the day-flying species. Further, the writer has collected four nymphalids, five pierids and one lycaenid at light — all of these normally considered to be diurnal in their habits; however, as pointed out earlier, a few species of *Eurema* (Pieridae) show crepuscular tendencies. The evidence thus far shows more diurnal species being attracted to light than the so-called crepuscular species.

The writer has never taken *Papilio demoleus, Precis orithya, Danaus chrysippus, Gangara thyrsis* and *Talicada nyseus* at light — species reported at light in India by other writers — but these records also support the theory that more diurnal species are attracted to light than are the crepuscular species. But, as Mr. Donahue has so well stated in this *Journal of the Lepidopterists' Society*, "Further observations and experimentation will undoubtedly aid in the interpretation of this interesting phenomenon" (Vol. 16: p. 135).

Since only certain species of moths are attracted to light and many others seem to have no attraction to light, it does not seem unreasonable to conclude that a few species of butterflies also may be attracted to light. The occurrence of so many species at light — and occasionally by the score — can scarcely always be due to some accidental disturbance of the butterflies when at rest.

In conclusion, it should be noted that at least twenty-two species of butterflies, representing seven of the major families, have been collected at light in India. The writer has collected seventeen species of butterflies at light in India representing five major families.

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CORRECTIONS

On p.227 and 228 respectively, of vol. 13, no. 4, of the *Journal, Precis lavinia coenia* should be ascribed to Hübner and *Kricogonia lyside* to Godart. I am indebted to Mr. Cyril F. dos Passos for calling my attention to these errors. On p. 73 vol. 15, no. 1, of the *Journal,* the last sentence, second paragraph should read "overwinter in the larval stage".

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

Notice of proposed use of plenary powers in certain cases (A. (n.s) 63)

In accordance with a decision of the 13th International Congress of Zoology, 1948, public notice is hereby given of the possible use by the International Commission on Zoological Nomenclature of its plenary powers in connection with the following coses, full details of which will be found in *Bulletin of Zoological Nomenclature,* Vol. 21, Part 2 published on 23 April, 1964.

(7) Validation of the specific name *Griselda radicana* Heinrich, 1923 (Insecta, Lepidoptera). Z. N. (S.) 1612;

(8) Designation of a type-species for *Baetis* [Leach, 1815] (Insecta, Ephemeroptera). Z. N. (S.) 1620;

(9) Designation of a type-species for *Megalopta* Smith. 1853 (Insecta, Hymenoptera). Z. N. (S.) 1624;

(11) Validation of the family-group name Playtpleurinae Schmidt, 1918 (Insecta, Hemiptera). Z. N. (S.) 1626.

Any zoologist who wishes to comment on any of the above cases should do so in writing, and in duplicate, as soon as possible, and in any case before 23 October, 1964. Each comment should bear the reference number of the case in question. Comments received early enough will be published in the *Bulletin of Zoological Nomenclature.*

All communications on the above subject should be addressed as follows: The Secretary, International Commission on Zoological Nomenclature, c/o British Museum (Natural History), Cromwell Road, London, S. W. 7. ENGLAND.

W. E. CHINA
Acting Secretary to the International Commission on Zoological Nomenclature

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EARLY STAGES OF DICHOGASTER (LASIOCAMPIDAE): A CORRECTION

In 1958 I published the life history of what was thought to be *Eutachyptera psidii* (Sallé) (*Lepidopterists' News,* 11: 99-102.). This was based on material taken in Pinery Canyon, Cochise County, Arizona, and the species was determined by comparison with material in the Los Angeles County Museum collection.

Recently careful study has proven that the reared series is not *E. psidii,* but is the related species, *Dichogaster coronado* (Barnes). The life history of the latter species has not to my knowledge been described elsewhere.

JOHN A. COMSTOCK, Del Mar, California.

MONARCH BUTTERFLIES ARE EATEN BY BIRDS

by Bruce Petersen

University of Colorado, Boulder, Colorado

Introduction

The monarch butterfly (*Danaus plexippus*) is strikingly similar in appearance to the viceroy (*Limenitis archippus archippus*). A hypothetical explanation for the resemblance of these two animals was suggested by Walsh and Riley (1869). Their explanation has been accepted by the scientific community. Klots (1960: 37) states it this way: "The monarch (*Danaus*) is genuinely inedible, since it feeds on milkweed. It advertises this fact (warning coloration) by distinctive orange-brown color and slow, lazy flight. The viceroy (*Limenitis archippus*) which feeds on willow and popular is perfectly good bird food. But it has the colors and habits of the monarch. Without doubt it gains much protection from birds which have learned to leave alone anything that looks like a monarch. This is our best example of butterfly mimcry. In the tropics there are dozens more striking . . . " .

The hypothesis has been affirmed by Dr. J. V. Z. Brower (1958) who captured eight Florida scrub oak jays (*Aphelocoma coerulescens coerulescens*) and tried to feed four of them monarchs and swallow-tails while the other four were offered viceroys and swallowtails. Each butterfly had its thorax pinched before it was presented to a caged Jay. One group of birds ate all of the swallowtails offered and half of the viceroys. The other group ate all of their swallowtails and not one monarch. Dr. Brower concluded that monarchs are inedible, and that the viceroy is protected by its resemblance to the monarch.

The other side of the monarch-viceroy story has been presented by Dr. F. A. Urquhart who recently summarized arguments against accepting this hypothesis (1957, 1960). Here is a brief summary of Dr. Urquhart's arguments.

A general resemblance of the two mimetic forms, brought about by similarity of habitat, external conditions, or accidental coincidence may be required before predation begins to mold the mimic. (Bates, 1862).

Food habits of captive animals vary widely from normal, so experiments relying on the food habits of captive animals are suspect. Stomach analyses of wild animals are the best evidence of their food preferences (McAttee, 1932a).

Analysis of stomach contents of birds does not support the mimicry hypothesis (McAttee, 1932b).

No butterfly-predator has been suggested as the evolutionary force

responsible for mimicry (Punnett, 1915; Dewar and Finn, 1919).

Birds frequently eat caterpillars (which show no mimcry) and rarely eat butterflies (which supposedly mimic each other frequently). If natural selection were responsible for mimicry one would expect to find it in caterpillars – not butterflies (Dewar and Finn, 1919).

Even very distasteful creatures are better off to be inconspicuous than to be brightly colored (Dewar and Finn, 1919).

All Fifty people tested found nothing sharp or bitter or otherwise objectionable about the taste of monarch butterflies (Urquhart, 1957).

Only in Dr. Brower's work is there any indication that birds dislike monarch butterflies, and she used paralyzed butterflies and caged birds. It has yet to be shown that birds dislike the taste of monarch butterflies (Urquhart, 1960).

Birds have a very poorly developed sense of taste and smell (Pumphrey, 1948; Wallace, 1955; and Gurney, 1922).

Under natural conditions birds are almost never seen feeding on monarch butterflies. This would indicate that birds know nothing of their taste, for they have never been observed in the process of learning that monarchs are inedible. Is it not more likely that monarch butterflies fail to elicit a feeding response in birds? – that monarchs don't look like birdfood? (Urquhart, 1957).

Monarchs tagged for migration experiments have been eaten in large numbers – apparently because their appearance had been altered (Urquhart, 1957).

Mimicry theory fails to explain why the banded purple doesn't mimic the monarch, as it is the same genus as the viceroy. Or. if the banded purple is successful, why the viceroy didn't mimic it instead of the distantly related monarch? (Urquhart, 1960).

EXPERIMENTS

As an aid in understanding the relationship between birds and monarchs, Dr. Urquhart's hypothesis that monarchs don't evoke a feeding response in birds was tested.

In the summer, monarchs are common over the grounds of the Iowa Lakeside Laboratory, near Milford, Iowa. In the caretaker's back yard are a birdbath and two feeding stations which attract a wide variety of birds. In the summer of 1963, five species were frequent visitors: cardinals, brown thrashers, grackles, robins, and english sparrows. They were fed on table scraps of every sort, birdseed, and suet. A white enamel pan was placed on the ground in this yard between the birdbath and one of the feeders. Live (and lively) monarch butterflies, after having their wings trimmed off, were placed in the pan

every morning before dawn. Removing the butterflies' wings altered their appearance drastically. They looked like elongated, jumping, black spiders with tetany; and they did elicit a feeding response in the birds. Nearly every morning for two weeks the birds emptied the pan. The best customers were the brown thrashers, one pair of which was observed feeding the butterflies to their young. Between July 18 and July 31, 110 of 112 wingless monarchs were eaten (Graph 1). The birds that ate them could have lived off a bounteous Iowa summer, or the food in the bird feeders if monarchs were distasteful to them.

Between December 24, 1963, and January 3, 1964 a similar experiment was run at the edge of the Garden of the Gods in Colorado Springs, Colorado, where Mr. Paul Nesbit feeds birds on his patio. A subspecies of scrub oak jay (*Aphelocoma coerulescens*) is found here. A baking dish containing the butterflies was placed in the yard near some suet, birdseed, and cracked corn. Every day for four days the live, wingless butterflies were eaten by the jays. On December 27 monarchs with wings were offered in the dish, and these, too, were eaten. Moving pictures were taken of the feeding jays. Early in the morning the butterflies were immobilized by the cold, but as the temperature edged into the forties and fifties they would become quite lively. One monarch flew off as a jay pecked at it and the jay followed in fast pursuit. Although he snapped at the flying butterfly for fifteen yards, the jay did not catch it. How much better could the monarch have avoided capture at 85 degrees F. over an Iowa meadow? After that event, the major wing vein (the costa) was severed on the remaining butterflies so they could not fly, but only flutter and hop. There were eighty monarchs with wings eaten in that week, with most of them going to the scrub oak jays, some to pinon jays, and one to a chickadee. The last one to be eaten had been lying dead on the patio for four days. A day-by-day tabulation of the butterflies is presented in graph 1.

Conclusions

Five common species of birds will eat wingless monarch butterflies in the summer in Iowa when they are placed near the birds' usual feeding station in a lively condition.

Scrub oak jays and pinon jays will eat monarch butterflies even with wings in the winter in Colorado if the butterflies are lively, but cannot fly, and are placed near where the birds usually feed.

These experiments appear to support Dr. Urquhart's hypothesis that the monarch butterfly is not eaten under entirely natural conditions because it doesn't elicit a feeding response in birds – it doesn't look like food. These experiments seem consistent with his explanation of why the butterflies he tagged were eaten by birds.

GRAPH 1

Date	Wingless monarchs		Monarchs with wings		Remarks
	offered	eaten	offered	eaten	
July 18	5	4			It was difficult to catch enough
19	4	3			butterflies at first.
20	5	5			
21	5	5			
22	7	7			
23	10	10			
24	10	10			
25	6	6			
26	10	10			
27	10	10			
28	10	10			
29	10	10			
30	10	10			
31	10	10			
Dec. 24	10	3			All of the butterflies used in
25	10	10			Colorado were transported from
26	10	10			Carmel, California.
27	10	10	27	25	The butterflies were taken in early
28			20	18	on the 29th as the sky was too
29			10	3	cloudy for photographs.
30			25	21	
31			6	1	The jays were absent on 12/31
1			8	5	and 1/1, but returned on 1/2 to
2			7	7	eat the few remaining butterflies
					by 9:30 A.M.

These experiments appear to deny the conclusions of Dr. Brower and Dr. Klots that the monarch is "genuinely inedible". They seem to call into question the basis of the mimicry hypothesis that has long

been used to explain the resemblance of the monarch and viceroy butterflies.

AKNOWLEGEMENTS

I am indebted to Dr. L. N. Garlough, Dr. H. G. Rodeck, Dr. R. L. King, Mr. and Mrs. Paul W. Nesbit, and Mrs. M. Mac Kinstry for their help in this project.

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THE STORY OF A "MIXED UP" *THORYBES PYLADES* (HESPERIIDAE)

While on a collecting trip near Warsaw, Missouri in early April of 1963 I observed a male *Thorybes pylades* Scudder hovering about six inches above the ground in the mating ritual common to the species. I cautiously advanced intending to drop my net over a pair of *pylades.* Then much to my surprise I saw that the object of *pylades* intentions was not a female of the species but a dark little *Euclidina cuspidea* Hübner. This moth, a member of the family Noctuidae is a common spring species found in wooded areas. It has nervous habits, is easily flushed from the ground, and flies in a skipper-like manner. In fact on several occasions I have started to catch specimens thinking they were specimens of one of the *Erynnis* species. It was thus with a bit of satisfaction that I saw

this moth could even fool a skipper into thinking it was one of its own. I gave up collecting butterflies for a moment and decided to watch the outcome of this little drama. The male *pylades* dipped lower until the moth, startled, skipped a dozen yards away and settled again among the dead leaves. Right behind came *pylades* and the same thing transpired a second time. The skipper began the nuptial ritual, dipping lower and lower until the moth was startled into flying away to a new location. I followed a few steps behind and witnessed the same procedure a total of eleven times before the tormented little moth finally crawled deep into a clump of dried grass and the disgruntled skipper after a few circles about the grass clump went off in search of a less reluctant recipient of his charms. I watched very carefully the rest of the day to see if this phenomena would occur again and was twice rewarded. On one occasion a series of five passes was made at a *cuspidea* and the other time a token pass was made at another *cuspidea*. In both of these cases the skipper gave up while the moths were still resting in the open. All three of the moths were collected and provd to be males in quite fresh condition. I did not collect the skippers and the possibility exists that the same individual was involved in each instance although they occured at widely separated points in the woods.

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COMMENT ON AE'S LARVAE OF INTERSPECIFIC HYBIRDS IN BLACK SWALLOWTAILS IN JAPAN

In his 1963 paper on *Papilio* hybrids (*Journ. lepid. soc.* 17: 163-169) Dr. Ae refers to differences in the stripes on the 4th, 5th, and 6th abdominal somites of the various larvae. In my experience these stripes vary considerably between larvae of the same species and can in no way be taken as an indication of species.

In the larva of the African *Papilio demodocus* Esp., with which I am now most familar, the stripes appear to vary with the degree of light experienced by the larva. I have found larvae feeding on orange trees growing in full sunshine with these stripes completely obsolete. Larvae reared in the dark have the stripes continuous, heavy, and blackish in colour, and a complete cline can be made from unstriped to heavily striped larvae and with the colour of the stripe varying from almost blackish to a pale lavender-brown.

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FOUR NEW SPECIES OF *AGATHYMUS* FROM TEXAS (MEGATHYMIDAE)

by H. A. Freeman [1]

1605 Lewis, Garland, Texas

I, as well as Stallings & Turner, have know for several years that there were several species mixed in material we have been calling *Agathymus mariae* (B. & B.) in Texas. During the past six years I have been making a detailed study of that particular species complex. In working with this problem I used 32 locations in Texas and one in New Mexico and these constitute the known range of this species complex in the United States. As *Agave lecheguilla* Torr. is the known food plant of members of this complex their range can be followed by checking the range of the food plant.

In making a study of the various habitats, the following information on each was carefully noted: location, date, plant associates, type of soil, pH of the soil at the feeding level of the plant, elevation, average annual rainfall and the presence or absence of radiation. One of the most significant factors was the isolation of certain areas from the main gene pool of *mariae*. Another appeared to be the pH factor which seemed to have an influence on the presence or absence of various species in a given habitat. Typical *mariae* is distinctly associated with alkaline soil where the average is just below 8. In the area around Del Rio, Juno and Bracketville in Texas the reading is 7 or just slightly above, indicating near neutral or neutral soil. In the Chinati mountains the pH was around 7.4. In the area 10 miles west of Lajita, where a new species was located, the pH was 7.3. Since radiation has been used to bring about production of mutant genes, I thought that by checking radiation in the various locations with a Geiger counter some answer might present itself concerning individual variation in the various habitats, however there was not sufficient radiation recorded in any of the habitats to warrant such results.

As we are uncertain as to which made its appearance first, the host or the parasite, it is a little difficult to determine just when the prototype of our present *mariae* complex appeared. Indications are that *Agave lecheguilla* once covered the entire area from the Edwards Plateau to El Paso; however many factors have accounted for its disappearance in many places, producing desert and mountain islands. In its eastern range, especially around Juno, Del Rio and north of Bracketville the plants do not appear to be typical *lecheguilla*, and the colonies of plants

[1] I would like to express my appreciation to the National Science Foundation for research grants G-9900 and GB-398 which has made this research possible.

are very local, indicating that they have been isolated from typical *lecheguilla* for many years. This polytypy may have some bearing on differences exhibited by members of the *mariae* complex found in this section of the state, as they have evolved sufficiently to represent separate species, differing from typical *mariae* found over most of western Texas. In the Chinati Mountains, Presidio Co., we have a similar situation, since this area apparently has been cut off from the main gene pool of *mariae* for many years, and isolation and other factors have resulted in the formation of a new species, the description of which follows.

AGATHYMUS CHINATIENSIS Freeman, NEW SPECIES

FEMALE. Upper surface of primaries: dark gray, with a heavy overscaling of ochraceous hairs and scales over the middle and basal area. Markings deep yellow: a large cell spot (spot 1), 3.5 mm wide at costa and 2 mm wide at bottom; four linear, subapical spots, averaging 1.5 mm wide; the two extradiscal spots touch outer edge of lower subapical spot and are fused together; discal band composed of three somewhat fused spots, forming a straight line down their outer surface, the one in interspace 1 (spot 9) is broad, 4-5 mm wide, pointed on its inner surface, the one in interspace 2 (spot 8) is broadly linear, 4.5 mm wide, the one in interspace 3 (spot 7) originates just beneath inner edge of lowest extradiscal spot and terminates just beneath cell spot, width 4 mm. The ochraceous overscaling terminates abruptly basad to cell spot, pure ground color between this and discal spots. Fringes alternately dark gray and light tan.

Upper surface of secondaries: ground color dark gray, overscaling heavier than on primaries, giving a somewhat golden cast to the wing. Markings deep yellow: a well defined spot half way between discal band and base, with a smaller spot slightly beneath and inward from it; an evenly curved discal band, composed of six spots, more or less fused together, varying width from 4 mm to .5 mm near the costal area, all except costal spot wide and well defined. Fringes alternately gray and sordid yellow.

Under surface of primaries: dark gray, heavily overscaled with lighter gray scales, especially near apical area. All spots reappear, lighter in coloration.

Under surface of secondaries: dark gray ground color heavily overscaled with steel-gray scales. All spots reappear yellowish-white, in marked contrast with ground color.

Thorax above grayish-brown, lighter gray beneath. Abdomen with first three segments above of same coloration as thorax, remainder grayish; beneath lighter gray, like thorax. Palpi sordid white. Legs same color as under side of thorax and abdomen. Antennae sordid white with black rings, basal third of club sordid white, remainder black.

Wing measurements. Holotype female, primaries: base to apex, 26 mm; apex to outer angle, 16 mm; outer angle to base, 15 mm; secondaries: base to end of Cu_1, 19 mm; costa to anal angle, 14 mm; total expanse, 52 mm. (average of the paratypes, 54 mm).

MALE. Upper surface of primaries: grayish-black, with considerable yellowish-gray scales near the base. Markings deep ochreous yellow: a spot at end of cell 2.5 mm long; the three subapical spots linear, well-defined, the one in interspace 6 (spot 4) out of line towards apex; the two extradiscal spots well defined, not touching subapical or discal spots; discal band composed of three separated spots, which are in line. the one in interspace 1 broadly columnar, 2.5 mm wide in center, the one in interspace 2 is broad, 4 mm wide, rounded on outside, pointed on inside towards base, the one in interspace 3 straight on outside, pointed on top inside toward cell spot, 3 mm wide. Fringes alternately gray and sordid white.

Upper surface of secondaries: grayish-black, sparsely overscaled with ochraceous-yellow hairs and scales. Markings deep ochreous yellow: a spot two-thirds of the way towards base from discal spots and the slightest indication of another one slightly beneath and inward from first; a curved discal band of five spots, which varies in width from 2 mm to .8 mm, with the upper spot being out of line inward. Fringes alternately gray and sordid yellow.

Under surface of primaries: dark grayish-black, with lighter gray overscaling over apical area and between cell spot and subapical spots. All spots reappear and are lighter in coloration.

Under surface of secondaries: ground color grayish-black, with lighter gray over-scaling. A white subcostal spot and all other spots reappear from above, sordid white, giving wing a mottled appearance.

Thorax, abdomen, palpi, legs and antennae same as in female. Wing measurements. Allotype male, primaries: base to apex, 26 mm; apex to outer angle, 15 mm; outer angle to base, 19 mm; secondaries: base to end of Cu_1, 18 mm; costa to anal angle, 15 mm; total expanse, 55 mm. (average of the paratypes, 50 mm.).

HOLOTYPE female, 2.7 miles south of Shafter, Texas, 5 October 1960, reared in *Agave lecheguilla* Torr.; allotype male, same location and food plant, 15 October 1960; both were collected by the author and will be deposited in the American Museum of Natural History. Described from 31 specimens (17 males and 14 females collected in the larval stage by the author at the following locations in Texas: 2.7 miles south Shafter, Presidio Co., el. 4000 feet, pH 7.1 (type locality), 9♂♂ 9♀♀, emerged September and October, 1960-61; Chinati Mountains, el. 4350 feet, pH 7.4, 5♂♂, 2♀♀, emerged September and October 1960; 19 miles south Marfa, el. 5200 feet, pH 7.3, 3♂♂, 3♀♀, emerged during October 1957. One pair of paratypes will be placed in each of the following collections: Yale University, American Museum of Natural History, and Stallings and Turner. The rest of the paratypes are in the collection of the author. This species is named for the mountains where it occurs.

In comparing *chinatiensis* with *mariae* there are a number of differences that can easily be detected. In the males all spots are larger and somewhat differently shaped from those in *mariae*, especially spots 7, 8, and 9, which are all of about the same width, while in *mariae* they progressively increase in size with 9 being the largest. The ground color is dull grayish-black in *chinatiensis*, while in *mariae* there is a brownish overcast. On the lower surface of the secondaries there is more contrast between the light and dark areas in *chinatiensis* than there is in *mariae*. In the females the same differences are noted as in the male as both sexes exhibit a greater contrast between the maculation and the ground color than does *mariae*. The maculation in *chinatiensis* has a little more orange in it than does *mariae*. Genitalic differences can be noted on plate 3. The pupal cremasters show some differences which are shown on plate 3.

The food plant is *Agave lecheguilla* Torr. The type locality is near highway 67, 2.7 miles south of Shafter, Texas. It is mountainous, el.

4000 feet, with outcroppings of limestone and extremely rocky, pH 7.1; plant associates are catclaw and scrub cedars. The larvae are bright blue similar to *mariae*, and they feed on the leaves of *lecheguilla* and penetrate to a depth of 16 mm. into the caudex. Larvae of *mariae* seldom go more than 4-5 mm into the caudex, with their tunnel being from 65-70 mm in length; while the length of *chinatiensis* tunnels varies from 71-82 mm. The trap door occurs on the upper side of the leaf well up from the base.

Ten miles west of Lajita, Texas. in Presidio Co., a small colony of *Agathymus* was found that possibly represents an unnamed Mexican species which just barely enters Texas in this one area. South of the Rio Grande just below this region, there are rugged mountains, well covered with *lecheguilla,* and so far they have never been collected for Megathymidae. The description of this new species follows.

AGATHYMUS LAJITAENSIS Freeman, NEW SPECIES

FEMALE. Upper surface of primaries: dark gray, with a slight overscaling of fulvous near base. Markings tan: an indistinct light spot two thirds the distance towards base; cell spot of two linear spots fused together, the upper one displaced slightly inward, 3 mm wide; four broad, linear, subapical spots, fused together forming a band that angles out at bottom to touch upper large extradiscal spot, all spots about 2.5 mm wide; discal band of three separate, spots, the one in interspace 3 pointed on outside and inside, broad, 4 mm, extending from just beneath lowest extradiscal spot just to under edge of cell spot, the one in interspace 2 rounded on its outer surface and straight on inner surface, 5 mm wide, the one in interspace 1 straight on outer surface and bluntly pointed on inner surface, toward base, 6 mm wide. Fringes light tan with slight indication of darker gray checkering.

Upper surface of secondaries: same dark gray color as primaries, with slightest indication of grayish overscaling near base. Markings tan: a well defined spot near center of wing and sometimes another, smaller, spot beneath first; discal band evenly curved, of five separate, well defined spots, the one near anal angle squarish, 3 mm wide, the next one indistinctly pointed at bottom, 2 mm wide, the next one sharply pointed outward, 1 mm wide, the next one one somewhat rounded, 3 mm wide, above fourth one a triangular spot 1 mm wide. Fringes grayish-tan with the slightest indication of darker checkering.

Under surface of primaries: grayish-black, with some lighter grayish overscaling at apex. All spots reappear, only slightly lighter in color than on upper side.

Under surface of secondaries: dark gray, rather sparsely overlaid with light gray scales. Discal band reappears, white; a white spot near center of wing and a white subcostal spot. A darker area between center spot and discal band, giving wing a mottled appearance.

Thorax brownish-black above, gray beneath. Abdomen of the same color as thorax. Palpi light gray. Legs same color as under side of thorax. Antennae gray, ringed with black, club having basal third gray, remainder black.

Wing measurements. Holotype female, primaries: base to apex, 26 mm; apex to outer angle, 16 mm; outer angle to base. 20 mm; secondaries: base to end of Cu_1, 20 mm; costa to anal angle, 15 mm; total expanse, 53 mm (average of the paratypes, 53 mm).

MALE. Upper surface of primaries: black with a slight purplish overcast, some fulvous overscaling near base forming an indistinct spot two thirds the distance in towards base of wing. Markings orange-brown: cell spot is small and rounded;

three subapical spots, the lowest one out of line outward; the two extradiscal spots small and round, placed outward from subapical spots; discal band composed of three widely separated spots, the one in interspace 3 broad, 2.5 mm, pointing towards cell spot, the one in interspace 2 more rounded, of the same width, the one in interspace 1 broadly L-shaped, of the same width. Fringes gray showing only the slightest indication of checkering.

Upper surface of secondaries: same coloration as primaries. A distinct spot near center of wing; discal band evenly curved, made up of five separate spots; the one near anal angle 2.5 mm wide, the next one 1.5 mm, the next .5 mm, the next linear, 2.5 mm long, the last one is above the linear spot, slightly oval, .5 mm wide. Fringes alternately gray and light tan.

Under surface of primaries: black, with some lighter gray overscaling near apex. All spots reappear, lighter in coloration.

Under surface of secondaries: ground color dark gray, rather sparsely overscaled with light gray, giving the wing a rather blotched appearance. Two sordid white, subcostal spots; a light gray area from near the center of wing to base, discal band light, leaving a darker area between these two regions.

Thorax, abdomen, palpi, legs and antennae same as in female.

Wing measurements. Allotype male, primaries: base to apex, 25 mm; apex to outer angle, 14 mm; outer angle to base, 19.5 mm; secondaries: base to end of Cu_1, 19.5 mm; costa to anal angle, 13 mm; total expanse, 52 mm (average of the paratypes, 52 mm).

HOLOTYPE female, 10 miles west of Lajita, Texas, 2 October 1961, reared in *Agave lecheguilla* Torr.; allotype male, same location and food plant, 8 October 1962; both were collected by the author and will be deposited in the American Museum of Natural History. Described from 21 specimens (11 males and 10 females). All specimens were collected by the author in the larval stage 10 miles west of Lajita, Presidio Co., Texas, el. 2650 feet, soil pH 7.3. These emerged during September and October 1961-62. One pair of paratypes will be placed in each of the following collections: Yale University, American Museum of Natural History and Stallings & Turner. The rest of the paratypes are in the collection of the author. This species is named for the area where it was collected.

In comparing *lajitaensis* with *mariae* and *chinatiensis,* the ground color is dull black, whereas in the latter two the ground color is more brownish-black. The males of *lajitaensis* have the spots reduced somewhat in size, especially on the secondaries. On the lower surface of the secondaries the spots reappear and some are clear white, thus showing a marked contrast with the ground color. The fringes are lighter in *lajitaensis,* being yellowish white, while in *mariae* and *chinatiensis* they are more yellowish-tan. In the females there is a tendency for the discal band on the upper surface of the secondaries to be made up of distinct spots, while in *mariae* and *chinatiensis* these spots tend to be fused together. The discal band reappears on the lower surface of the secondaries and is often clear white, producing a distinct contrast with the dark gray ground color. In *mariae* the ground color of this area is much lighter and the discal band is more ochraceous. In *chinatiensis* the

ground color is even lighter than in *mariae*, with the discal band light yellowish-tan and contrasting sharply with the ground color. The color of the spots in both sexes is very similar to that of *mariae*. Genitalic and cremaster differences can be noted on plate 3.

The food plant is *Agave lecheguilla* Torr. The type locality is 10 miles west of Lajita, Texas, in Presidio Co., near highway 170. This is in a valley, el. 2650 feet, surrounded by rugged mountains. The soil is very rocky and grayish in color, pH 7.3. Plant associates are sotol, ocotillo, scattered *Yucca torreyi* Shafer and many cacti. The larvae are lighter blue than *mariae* and they feed primarily on the leaves, only penetrating the caudex to a depth of 14 mm. The tunnel length varies from 80-82 mm with the trap door well up on the upper side of the leaf.

There is a very interesting area in Texas extending from Boquillas Canyon up to just west of Dryden and over through Langtry and Del Rio to 14 miles north of Bracketville. Evolution has taken place resulting in the presence of three species in parts of this area. The description of one of these new species follows.

AGATHYMUS GILBERTI Freeman, NEW SPECIES

FEMALE. Upper surface of primaries: grayish black, basal third of wing overlaid with yellowish-gray scales and hairs. Markings yellowish-tan: cell spot large, three minute, linear spots above it, width of cell spot 2-3 mm; four linear, subapical spots, average width 1.5 mm; the two extradiscal spots well defined; discal band composed of three separate, spots, the one in interspace 3 broadly oval, lying midway between cell spot and lowest extradiscal spot, 3-4 mm wide, the one in interspace 2 rectangular, 4 mm wide, the one in interspace 1 broad, 5 mm, straight on outer surface and sharply pointed toward base on inner side; all three spots form a more or less straight line down their outer surfaces, located inward from lowest extradiscal spot, about a third the way in from outer margin of wing. Fringes alternately dark and light gray.

Upper surface of secondaries: grayish black, with some golden hairs and scales forming a light overscaling over wing, especially near base. Markings yellowish-tan: a lighter area near center of distance between discal band and base of wing, which varies from two indistinct spots to a narrow line; discal band composed of six well defined spots, the first four from anal angle outward, form a straight line, the fifth one located almost directly above fourth, sixth inward from fifth and just below costal area; first and fourth discal spots large, 2 mm wide, third small and somewhat oval, 1 mm wide. Fringes alternately white and gray.

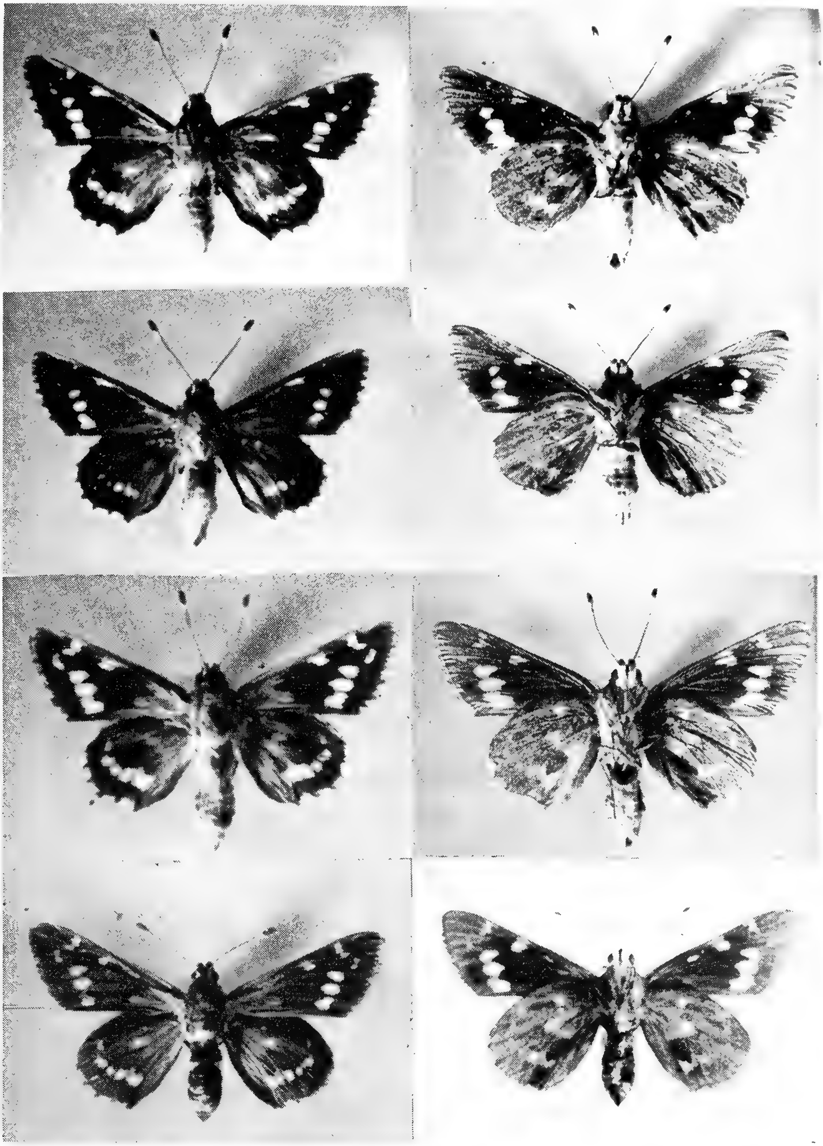
Under surface of primaries: grayish brown, with apical region heavily overscaled with light, steel gray. All spots reappear, lighter than above.

Under surface of secondaries: gray, heavily overscaled with steel gray, only a slight indication of discal band in some specimens, others immaculate.

Thorax above light gray, beneath even lighter, nearly white between legs. Abdomen same color as thorax. Palpi light, sordid white. Legs light gray. Antennae gray, ringed with dark brown, club having basal third light gray, the remainder purplish-black, the tip reddish-brown.

Wing measurements. Holotype female, primaries: base to apex, 25 mm; apex to outer angle, 14.5 mm; outer angle to base, 19 mm; secondaries: base to end of Cu_1, 18.5 mm; costa to anal angle, 15 mm; total expanse 51 mm (average of paratypes, 51 mm).

MALE. Upper surface of primaries: black, some slight grayish overscaling near apex, brown near base. Markings light yellowish-tan: a small, linear, cell spot; subapical spots variable, ranging from none to three, indistinct, linear dots; extradis-



EXPLANATION OF PLATE 1

Top row: *Agathymus rindgei* Freeman ALLOTYPE ♂, 14 miles north of Bracketville, Texas, 15 Oct. 1958. 2nd row: *Agathymus gilberti* Freeman ALLOTYPE ♂, 14 miles north of Bracketville, Texas, 21 Oct. 1959. 3rd row: *Agathymus chinatiensis* Freeman ALLOTYPE ♂, 2.7 miles south of Shafter, Texas, 15 Oct. 1960. Lower row: *Agathymus lajitaensis* Freeman ALLOTYPE ♂, 10 miles west of Lajita, Texas, 8 Oct. 1962.

cal spots absent or indicated by a minute dot or two; discal band composed of three widely separated, variable spots, the one in interspace 1 rather tall and narrow, slightly wider at base than at top, 1 mm wide in middle, the spot in interspace 2 round, 1.2 mm wide, the one in interspace 3 linear, 1.5 mm wide. tan. Fringes alternately dark gray and white.

Upper surface of secondaries: black, with some light brown overscaling, especially near base. Markings a trace darker than those of primaries; some specimens show a lighter spot near base of wing; discal band normally composed of four rather indistinct spots, forming a straight line, the one near the anal angle 1 mm wide, succeeding spots progressively smaller until the last two are mere dots; in a few specimens a fifth spot present, above last two in normal discal band. Fringes alternately white and gray.

Under surface of primaries: black, with apical third of wing heavily overscaled with steel gray, some specimens with indication of a light blue cast. The cell spot well defined, sordid white; the discal spots reappear prominently, lighter than above; no indication of extradiscal spots subapical spots reappear only rarely.

Under surface of secondaries: gray, heavily overscaled with steel gray giving wing an even appearance; some specimens with a small, white, spot beneath costa and some indication of the discal band by an indistinct white area.

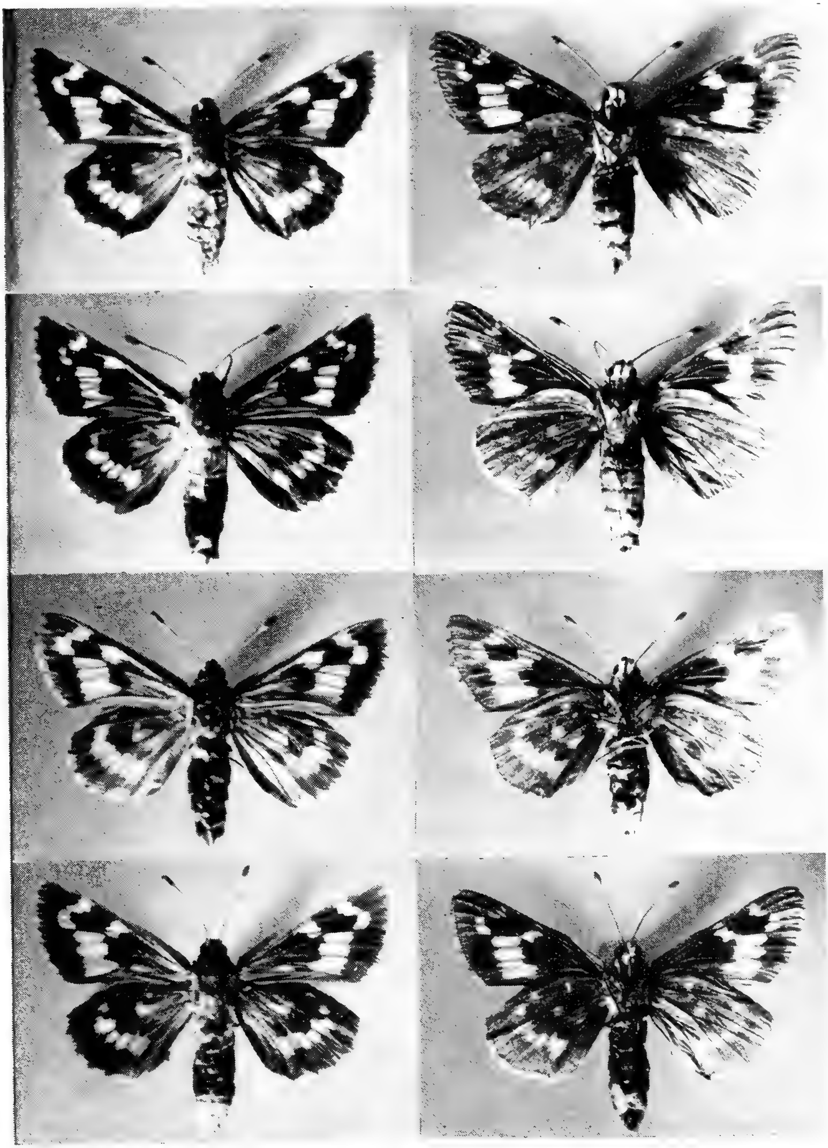
Thorax above dark gray, beneath much lighter, nearly white between legs. Abdomen dark gray above, lighter beneath. Palpi, legs and antennae same as in female.

Wing measurements. Allotype male, primaries: base to apex, 24 mm; apex to outer angle, 13 mm; outer angle to base, 18 mm; secondaries: base to end of Cu_1, 16.5 mm; costa to anal angle, 13 mm; total expanse, 50 mm (average of the paratypes, 50 mm).

HOLOTYPE female, 14 miles north of Bracketville, Texas, 22 October 1961, reared in atypical *Agave lecheguilla;* allotype male, some location and food plant, 21 October 1959, both were collected by the author and will be deposited in The American Museum of Natural History.

Described from 120 specimens (65 males and 55 females) collected in the larval stage by Gilbert Freeman, Louise Freeman, Stallings & Turner and the author at the following locations in Texas: 14 miles north of Bracketville, Kinney Co., el. 1500 feet, pH 7.1 (type locality), 22♂♂, 20♀♀, emerged September, October, November 1959-63; 28 miles north of Del Rio, el. 1450 feet, pH 7.1, 2♂♂, 3♀♀ emerged October 1958-62; 11-12 miles south Juno, el. 1450 feet, pH 7.1, 1♂, 2♀♀, emerged October, November 1959 and 1963; Pecos River Canyon, el. 1250 feet, pH 7, 2♂♂, October 1963; 10 miles east of Langtry, el. 1150 feet, pH 7, 2♂♂, 1♀, emerged October 1963; Langtry, el. 1150 feet, pH 7, 19♂♂, 20♀♀, emerged October, November 1959-63; 8 miles west of Dryden, el. 2150 feet, pH 7.3, 11♂♂, 4♀♀, emerged September, October, November 1959-62; near Boquillas Canyon, el. 1900 feet, pH 7.2, 6♂♂, 5♀♀, emerged September, October 1961-62. One pair of paratypes will be placed in the collections of Yale University and the American Museum of Natural History. There are 4♂♂ and 6♀♀ paratypes in the Stallings & Turner collection. The rest of the paratypes are in the collection of the author. I take pleasure in naming this new species for my son Gilbert, who helped collect part of the type series.

In comparing *gilberti* with the other species in this complex it does not approach *mariae, chinatiensis* nor *lajitaensis,* being closer to *mi-*



EXPLANATION OF PLATE 2

Top row: *Agathymus rindgei* Freeman HOLOTYPE ♀, 14 miles north of Bracketville, Texas, 23 Oct. 1961. 2nd row: *Agathymus gilberti* Freeman HOLOTYPE ♀, 14 miles north of Bracketville, Texas, 22 Oct. 1961. 3rd row: *Agathymus chinatiensis* Freeman HOLOTYPE ♀, 2.7 miles south of Shafter, Texas, 5 Oct. 1960. Lower row: *Agathymus lajitaensis* Freeman HOLOTYPE ♀, 10 miles west of Lajita, Texas, 2 Oct. 1961.

cheneri Stallings, Turner & Stallings in many respects. The general wing shape in *gilberti* is somewhat narrower than the others, including *chinatiensis* which has rather narrow wings; and the ground color is darker black with less overscaling near the base of the wings in both sexes. Spot 1 is reduced in size as are spots 2, 3, 4 (sometimes completely absent). Spots 5, 6 are absent or very small in the males. On the lower surface of the scondaries in both sexes the ground color is heavily overscaled with steel gray scales thus giving a rather even, smooth, appearance to this area. The discal band in the males on the upper surface of the secondaries is made up of small spots which form a straight line which does not appear in any of the other described species except rarely in *micheneri*. The color of the spots is light yellowish tan in both sexes. The fringes of the males are white alternating with dark spots. In the females spots 7 and 8 are narrow and usually reduced in size. Spot 7 does not approach spot 1. Spot 9 is usually elongated inward forming a broad L, somewhat like in the males of *micheneri*. In *micheneri* the discal band on the upper surface of the secondaries is straight but the spots are never reduced in size and are large and usually fused together. The coloration of the spots in *micheneri* is more orange than in any of the other species, especially *gilberti*. The females of *micheneri* have spot 7 very wide, reaching well under spot 1, a characteristic never present in *gilberti*. Genitalic and cremaster differences of *gilberti* can be noted on plate 3.

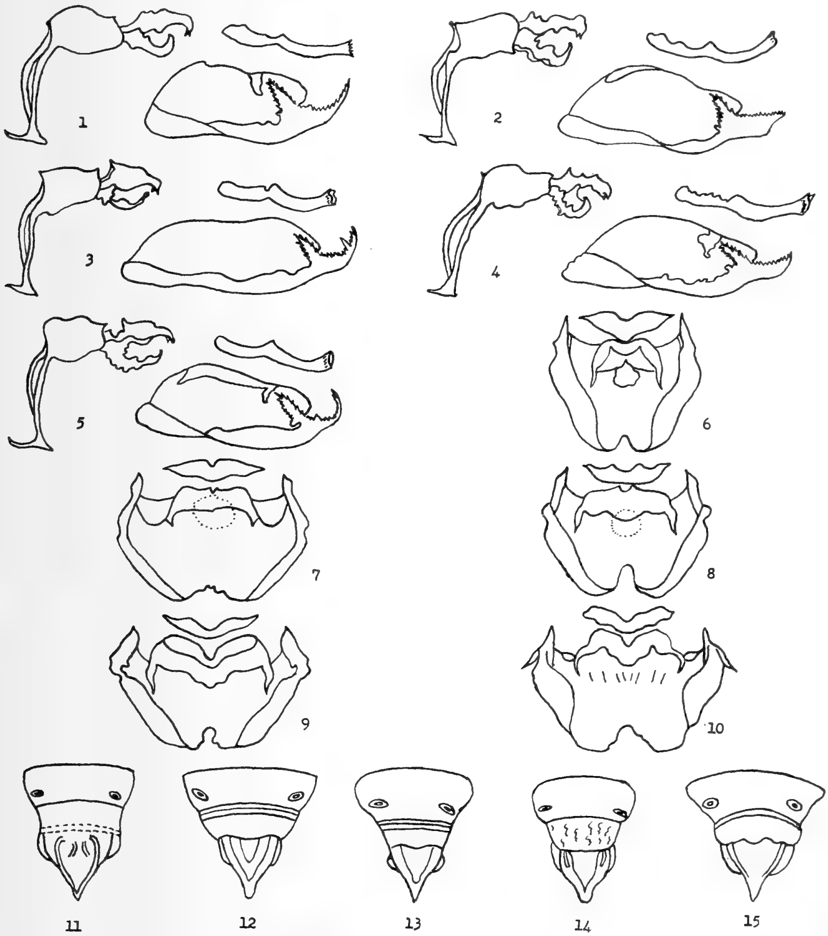
The foot plant is atypical *Agave lecheguilla*, possibly a closely related species. The type locality is 14 miles north of Bracketville, Texas, near farm road 674, in rolling hills, el. 1500 feet. The soil is very rocky and grayish in color, pH 7.1. The plant associates are *Yucca torreyi*, *Yucca thompsoniana* Trelease, cedars, *Nolina*, sotol, catclaw and mesquite. The larvae are dull, dark blue and feed on the leaves but penetrate will into the caudex of the *lecheguilla* plants, 20-30 mm. Their tunnels vary from 72-91 mm in length, and the trap door is located near the base of the leaf and on the upper side of the leaf. Sometimes feeding in the same plant will be larvae of *Agathymus estelleae* (Stallings & Turner) and the larvae of another species whose description will follow.

AGATHYMUS RINDGEI Freeman, NEW SPECIES

FEMALE. Upper surface of primaries: grayish black, with basal third of wing overscaled with yellowish-tan hairs and scales. Markings yellowish-tan: cell spot large, fusing into the three linear spots above, appearing as one large spot, 4 mm wide at top, 3 mm wide at bottom. four wide, 2 mm, linear, subapical spots; the two extradiscal spots well defined, upper one touching lower surface of last subapical spot; discal band composed of three broad, more or less fused spots, the one in interspace 3 broadly rectangular, 4 mm wide, nearly touching cell spot on its inner surface, originating just beneath lowest extradiscal spot, the one in interspace 2 broadly rectangular, 5 mm wide, the one in interspace 1 5 mm wide, pointed towards base; all spots form a straight line down their outer surfaces, located about

a fourth the distance in from outer margin of wing. Fringes alternately dark and light gray.

Upper surface of secondaries: grayish black, with some light fulvous hairs and overscaling near base of wing. Markings yellowish tan: two light, indistinct, spots near center of wing; discal band composed of six large, fused spots, the one nearest to anal angle irregularly square, 4 mm wide, the next linear, 2 mm wide, 4 mm long, the next linear, 1.5 mm wide, 2 mm long, the next made up of two fused spots, 4 mm wide, 2-3 mm. long, above this a square spot, 2 mm wide, inward toward the costa a narrow, linear, spot; whole discal band of spots slightly curved inward. Fringes alternately white and gray.



EXPLANATION OF PLATE 3

1. ♂ genitalia, *A. mariae* (B. & B.); 2. ♂ genitalia, *A. chinatiensis* Freeman; 3. ♂ genitalia, *A. lajitaensis* Freeman; 4. ♂ genitalia, *A. gilberti* Freeman; 5. ♂ genitalia, *A. rindgei* Freeman; 6. ♀ genital plate, *A. mariae* (B. & B.); 7. ♀ genital plate, *A. chinatiensis* Freeman; 8. ♀ genital plate, *A. lajitaensis* Freeman; 9. ♀ genital plate, *A. gilberti* Freeman; 10. ♀ genital plate, *A. rindgei* Freeman; 11. Cremaster, *A. mariae;* 12. Cremaster, *A. chinatiensis;* 13. Cremaster, *A. lajitaensis;* 14. Cremaster, *A. gilberti;* 15. Cremaster, *A. rindgei.*

Under surface of primaries: grayish-brown, apical region heavily overscaled with dark gray scales. All spots reappear, lighter in coloration.

Under surface of secondaries: dark gray, heavily overscaled with dark gray. Discal band reappears as a lighter area; two white spots below costa.

Thorax above grayish-brown, beneath lighter. Abdomen concolorous with thorax. Palpi light, sordid white. Legs gray. Antennae light gray, ringed with dark brown, club having basal third light gray, remainder black.

Expanse, wing measurements. Holotype female, primaries: base to apex, 26 mm; apex to outer angle, 16 mm; outer angle to base, 19 mm; secondaries: base to end of Cu_1, 20 mm; costa to anal angle, 15.5 mm; total expanse, 53 mm (average of the paratypes, 53 mm).

MALE. Upper surface of primaries: black, some fulvous overscaling over basal area. Markings orange-yellow: a well developed, linear cell spot; subapical spots well developed; the two extradiscal spots present, not always distinct; discal band composed of three well developed spots, the one in interspace 3 somewhat broadly triangular, 2 mm wide, the spot in interspace 2 round, 3 mm wide, the one in interspace 1 broadly columnar, 3 mm wide. Fringes alternately dark gray and sordid white.

Upper surface of secondaries: black, some fulvous overscaling, becoming heavier near base. Markings orange-yellow: a light spot usually present toward base of wing; discal band composed of five well defined spots, forming a slight curve inward, the one near anal angle 3 mm wide, the next one just under 2 mm wide, the next one 1 mm wide, the next linear, 3 mm long, 1 mm wide, the last a small spot, .5 mm wide. Fringes alternately white and gray.

Under surface of primaries: black, heavily overscaled with dark gray at apex. All spots reappear, lighter in coloration.

Under surface of secondaries: gray, heavily overscaled with dark gray. An indistinct, white subcostal spot; a sordid white area near center of wing, discal band reappears as a lighter area.

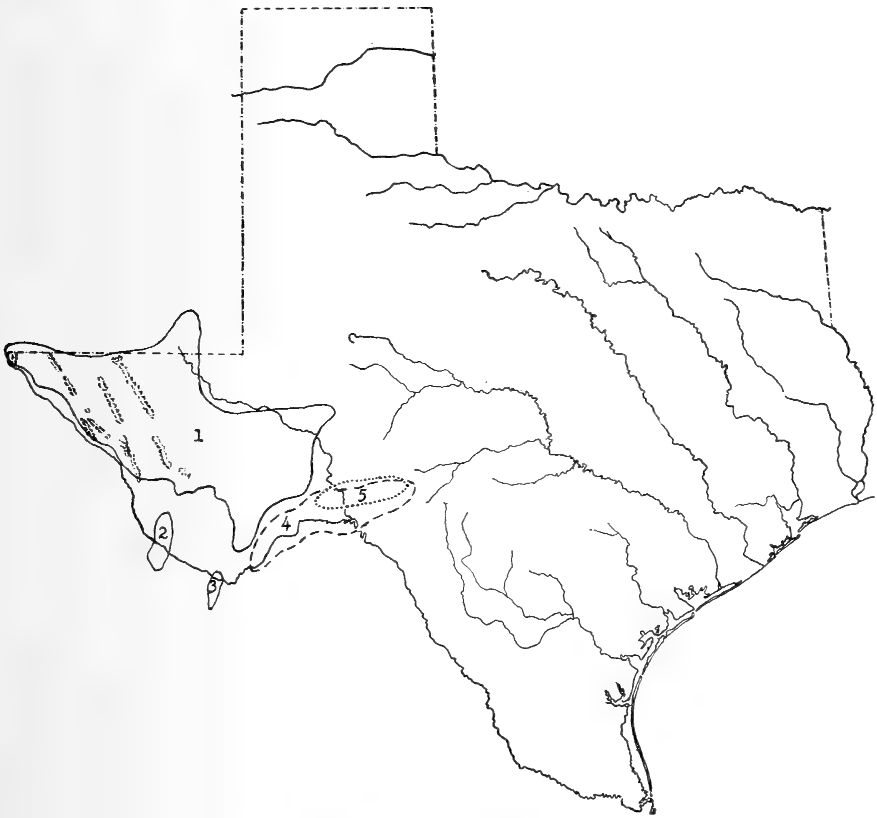
Thorax above dark gray, some fulvous hairs present, beneath lighter. Abdomen dark gray above, lighter beneath. Palpi, legs and antennae same as in female.

Wing measurements. Allotype male, primaries: base to apex, 25 mm; apex to outer angle, 15 mm; outer angle to base, 18.5 mm; secondaries: base to end of Cu_1, 18.5 mm; costa to anal angle, 14 mm; total expanse, 52 mm (average of the paratypes, 52 mm).

HOLOTYPE female, 14 miles north of Bracketville, Texas, 23 October 1961, reared in atypical *Agave lecheguilla;* allotype male, same location and food plant, 19 October 1958, both were collected by the author and will be deposited in The American Museum of National History. Described from 41 specimens (17 males and 24 females); 10 specimens were collected by Stallings & Turner and the rest by the author, all in the larval stage, at the following locations in Texas: 14 miles north of Bracketville, Kinney Co., el. 1500 feet, pH 7.1 (type locality), 10♂♂, 14♀♀, emerged September, October, November 1958-63; 28 miles north of Del Rio, Val Verde Co., el. 1450 feet, pH 7-1, 5♂♂, 6♀♀, emerged September, October, November 1958-63; 11-12 miles south of Juno, el. 1450 feet, pH 7.1, 2♂♂, 4♀♀, which emerged October, 1961-63. One pair of paratypes will be placed in the collections of Yale University and the American Museum of Natural History. There are 6♂♂, 4♀♀ paratypes in the Stallings & Turner collection. The rest of the paratypes are in the collection of the author.

I take pleasure in naming this new species for Dr. F. H. Rindge of the American Museum of Natural History, who has helped me in many ways with my studies of the Megathymidae.

In comparing *rindgei* with the other species in this group, it shows similarities to both *lajitaensis* and *gilberti*. The wing shape is broader than in either *lajitaensis* or *gilberti*. The general maculation is somewhat like *lajitaensis* in both sexes, but the ground color is darker and there is much less contrast on the lower surface of the secondaries since that area is heavily overscaled with steel gray scales much like in *gilberti*. In the males spots 1 through 6 are better defined than in *gilberti* and the discal band on the upper surface of the secondaries is not straight but is evenly curved, as in *mariae*, and is much better developed. In the females



Explanation of Map

Distributions of species of *Agathymus* in western Texas. 1, *A. mariae* (Barnes & Benjamin); 2, *A. chinatiensis* Freeman; 3, *A. lajitaensis* Freeman; 4, *A. gilberti* Freeman; 5, *A. rindgei* Freeman.

WING SHAPE COMPARISON OF THE VARIOUS SPECIES OF THE *Agathymus Mariae* COMPLEX*

	mariae		*chinatiensis*		*lajitaensis*		*gilberti*		*rindgei*		*micheneri*	
Primaries	♂♂	♀♀	♂♂	♀♀	♂♂	♀♀	♂♂	♀♀	♂♂	♀♀	♂♂	♀♀
Base to apex	23.5	26	23.5	26	23.5	26	23.5	26	23.5	26	23.5	26
Apex to outer angle	15	17	13	15	13	16	13	15	14	16	13.5	15
Outer angle to base	16	20	16	19	18	20	18	19	18	19	18	20
Secondaries												
Base to end of Cu_1	17.5	20	17	19	16.5	20	17	19	18	20	18	19
Costa to anal angle	15	17	13	15	13	16	13	15	14	16	14	15
	(broad)		(narrow)		(medium)		(narrow)		(broad)		(medium)	

*Measurements in millimeters.

all spots are larger than in *gilberti* and the discal band reappears on the lower surface of the secondaries, a somewhat lighter area. The fringes are the same as in *gilberti*. The color of the spots is somewhat darker than in *gilberti*. *A. gilberti* has chromosome count of 21, while all other Texas species have count of 22. Genitalic and cremaster differences can be noted on plate 3.

The food plant is the same as *gilberti*. The type locality is also the same as *gilberti*. The larvae are bright blue and feed on the leaves as well as into the caudex of the *lecheguilla* plant, 20 mm. Their tunnels vary from 72-83 mm in length and the trap doors are located fairly near the base of the leaf and always on the upper side.

The distribution of *mariae* can ne noted by the distribution map, which shows that it extends over most of western Texas, up to the Carlsbad National Park area, eastward to 2 miles east of McCamey, and well down into the Big Bend National Park area. In the area 8 miles west of Dryden it occurs along with *gilberti*, while just a little way westward from there at Sanderson only *mariae* occurs. At Boquillas Canyon and ten miles westward only *gilberti* occurs, while at the Headquarters of the Big Bend National Park and southeast towards the Boquillas Canyon area for two miles only *mariae* occurs. At Dryden *A. estelleae* occurs along with *gilberti* and *mariae*. At Langtry *gilberti* is common and only rarely will a specimen of *maraie* be found, with no specimens of *estelleae* so far having been collected 11-12 miles south of Juno *gilberti, rindgei* and *estelleae* occur together, as do they at the location 28 miles north of Del Rio. In the Del Rio area the dominant species is *estelleae*, with *rindgei* being next and *gilberti* rare. At the site 14 miles north of Bracketville *gilberti* is dominant and no specimens of *estelleae* were

collected prior to 1961, even though that area was heavily collected for three years before that year. Each year since 1961 *estelleae* has been getting more common there and now is as dominant as in some of the other locations where it had been collected before. *A. rindgei* is the least common species in the Bracketville area.

The photographs used in this article were made by Don B. Stallings.

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DISTRIBUTION OF PLEBEIUS SAEPIOLUS, LYCAENA MARIPOSA, AND HESPERIA COMMA ON VANCOUVER ISLAND

by Richard Guppy

Wellington, British Columbia

My "Distribution of Butterflies on Vancouver Island," appeared in 1956 in "The Lepidopterist's News" (Vol. 10: 169). The purpose of the present paper is to record some additional information concerning three of the species which were given special mention in the above article.

Concerning *Plebeius saepiolus insulanus* Blackmore, I wrote, "The V. I. population, so far as is known, is confined to Mt. Malahat". This information I received in conversation with Mr. Llewellyn-Jones, though

in his book "An Annotated Check List of the Macrolepidoptera of British Columbia", he gives southern V. I., without any precise localities. Actually he directed me to a small bit of territory between the road and railway track near Shawnigan Lake. I found this, however, such a disappointing place, that for several years I held to the view that Mr. Jones had just happened to come across the butterflies somewhere around there. About 1957 the entire railway right-of-way was saturated with weed killer, and the place became barren. In ensuring years I picked up the odd specimen of *P. saepiolus* further up the mountain, away from the railway, but by 1962 they were becoming fairly common beside the track as, I now realize, they had probably been when Jones collected there.

In 1963 I discovered another spot for *P. saepiolus,* about 20 miles north of Shawnigan Lake. I have used the name Mt. Sicker as a locality for these specimens, since it is the nearest point marked on maps. A highway has been cut through the steep lower part of this mountain, and the rocky slope goes up from the road in a series of benches. On the first of these, only a few minutes climb from the road, the *P. saepiolus* flies. As at Shawnigan Lake the main colony is confined to less than a quarter of an acre.

Both these *saepiolus* spots are old clearings that have grown up with grass, introduced European weeds, and tall bracken. Nothing like them could have existed when the land was in its natural state, since anywhere that the soil is rich and deep enough to support the above mentioned type of vegetation, forest would have taken over. Sometimes one comes across a kind of open forest of jack pines, with scrubby undergrowth consisting partly of lupins; this is the favorite haunt of other Plebeiinae: *Plebeius icarioides blackmorei* B. & McD. *P. melissa* (Edw.) and *Glaucopsyche lygdamus columbia* Skinner. Another type of hillside terrain, where there is almost no soil, is clothed with mosses, plants mostly of the lily family, and some wiry native grasses. All this vegetation can survive almost total dessication in summer; but neither of these habitats seems to support *P. saepiolus,* nor has I found it on roadsides or farm land. Most likely the nucleus from which my two colonies originated has not yet been spotted by a lepidopterist. It must be a type of country rather out of the ordinary for Vancouver Island.

In the case of *Lycaena mariposa* Reakirt I have to report a most extraordinary change in the situation as described in my earlier paper. At that time I wrote that the species occured on Mt. Arrowsmith, the Forbidden Plateau, and in one locality close to the road near Alberni. I did not notice, when putting down that information, that Jones had

no record of Mt. Arrowsmith as a locality for *L. mariposa.* I had, however, collected a single specimen there myself, in 1951. As for Jones' "summit of highway" as he called it, (this being the highest point the road reaches on the way to Alberni) although he took quite a series for his collection there, I have never found more than one or two *L. mariposa* there in any season since.

I believe that one of the reasons why I, and very possibly other collectors, have considered *L. mariposa* to be a scarce butterfly, lies in its very late season of flight. Below 3000′ it is seldom on the move before July 15th; above the timber line on Mt. Arrowsmith, between 5000′ and 6000′, it is not likely to be seen before August 20th. It is natural for collectors to get up into the mountains about as soon as the snow is gone, since the great bulk of the insects start to move then. During recent years I have taken to making a final visit to Arrowsmith very late in August, and on these trips I have found plenty of *L. mariposa.* The species has also turned out to be quite common on Mt. Benson, at about 3000′. I cannot say whether the *mariposa* were there all along, and I just happened to miss them; or whether, as seems quite possible, they were attracted by the vegetation that grew following the bad forest fire of 1951. The theory that I was usually too early on Mt. Benson is supported by my discovery of another late flyer, *Plebeius melissa,* there at the same time.

The whole question of host plants and habitat of *L. mariposa* is still a complete mystery to me. On Mt. Arrowsmith the species prefers swampy places where cotton grass grows. However, on Mt. Benson it flies in typical dry Plebeiinae territory, which has come back pretty much as before the fire, except that the jack pines are still tiny, growing only a few inches a year at that altitude. A great deal of searching for Polygonaceous plants has turned up one species, a tiny knotweed, *Polygonum minimum,* Wats. But these plants are so scarce and scattered that it is impossible to suppose that they support the larvae of all the *L. mariposa* present. A few females which I caged deposited a total of one egg on *P. minimum,* none on anything else that I tried, including common Polygonaceous weeds. The project is much held up by scarcity of females. nearly all the specimens which I collect are males. Since *L. mariposa* overwinters in the egg stage, it is to be expected that the eggs would be dropped at random. It may be that the presence of a few *Polygonum* plants stimulates oviposition, though the larvae manage to get along on something else when driven to it. The late brood of *Lycaena helloides* (Bdv.) also drops ova destined for spring hatching, and this species, late or early brood, readily oviposits on any Polygonacae.

In my earlier paper, the added note on *Hesperia comma* (L.)[1], that "by 1956 it had not spread at all" (from Oak Bay Park) was added to the proof. This has continued to be the picture, *H. comma* is common in the park at Oak Bay, but gets no further. Most likely it has been there all along. Mr. Jones never managed to collect this species. After he became too ill to collect any more, he told me that George Hardy had given him a few specimens from Victoria. It may seem strange that he overlooked a wanted species in such a handy place as Oak Bay Park, even more so that Mr. Hardy, who lives even closer to the spot, and does considerable Lep. collecting, did not find them before 1952. The park is a rather dry, uninteresting place in late summer, and it still seems possible that no collector bothered to try it at the right season. At any rate, that theory seems to me more plausible than supposing that *H. comma* suddenly established itself in the park, and then stayed right there.

Hesperia comma is also plentiful on Mt. Benson, it was there both before and after the fire. Commencing in 1959, the species spread down the mountain and into surrounding territory; until I began finding some individuals at Wellington. After a few years it receded up to the summit again. In the same way, during 1952 the Oak Bay colony had moved along the Saanich Peninsula, as far as the north end of Elk Lake, but they held to this extended territory for only a year or two.

In the "Report of the Provincial Museum" for 1954 a sight record of *H. comma* on the Forbidden Plateau is listed. An earlier issue of the same publication (1943) gives a complete account of Forbidden Plateau fauna as then known, and *H. comma* is not mentioned. I have three similar, single records (all specimens collected). One for Mt. Arrowsmith, one for Cameron Lake (where the Mt. Arrowsmith trail starts at about 600 ft.), and one for the "Highway Summit" spot, where Jones got his *Lycaena mariposa*. The latter specimen was doubly peculiar, in that it was flying along with "second early" butterflies, such as *Boloria epithore* Edw. and *Parnassius clodius* Men. Mt. Benson and Victoria are still the only places where I can regularly take *H. comma.*

[1]According to the recent treatment by MacNeill (1964, U. Calif. Publ. Ent., 35) this population is referable to *Hesperia harpalus oregonia* (Edw.).

RECENT LITERATURE ON LEPIDOPTERA

Under this heading are included abstracts of papers and books of interest to lepidopterists. The world's literature is searched systematically, and it is intended that every work on Lepidoptera published after 1946 will be noticed here. Papers of only local interest and papers from this *Journal* are listed without abstract. Readers, not in North America, interested in assisting with this very large task, are invited to write Dr. P. F. Bellinger (Dept. of Natural Sciences, San Fernando Valley State College, Northridge, Calif., U. S. A.). Abstractors' initials are as follows:

[P.B.] – P. F. Bellinger	[W.H.] – W. Hackman	[N.O.] – N. S. Obraztsov
[I.C.] – I. F. B. Common	[T.I.] – Taro Iwase	[C.R.] – C. L. Remington
[W.C.] – W. C. Cook	[J.M.] – J. Moucha	[J.T.] – J. W. Tilden
[A.D.] – A. Diakonoff	[E.M.] – E. G. Munroe	[P.V.] – P. E. L. Viette

E. Distribution and Phenology

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Darlow, H. M., "Additions to the list of the Lepidoptera of Malta." *Entomologist,* vol.83: pp.269-271. 1950. 18 new records. [P.B.]

Davis, J. J., "Insects of Indiana in 1954." *Proc. Indiana Acad. Sci.,* vol.64: pp.121-126. 1955. Phenology & abundance of pest insects, including Lepidoptera. [P.B.]

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Edwards, E. O., "Notes on Australian Lycaenidae; genus *Ogyris* (Azure Blue Butterflies)." *Proc. R. Zool. Soc. N. S. Wales,* 1954-55: pp.65-66. April 1956. Notes on rearing & distribution of *O. olane* & *O. amaryllis.* [I.C.]

Edwards, E. O., "Notes on some Hesperiidae." *Proc. R. Zool. Soc. N. S. Wales,* 1955-56: p.82. May 1957. Distribution & life history notes on *Badamia exclamationis, Trapezites phigalioides, Hesperilla o. ornata, H. c. crypsargyra.* [I.C.]

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RECENT LITERATURE ON LEPIDOPTERA

Under this heading are included abstracts of papers and books of interest to lepidopterists. The world's literature is searched systematically, and it is intended that every work on Lepidoptera published after 1946 will be noticed here. Papers of only local interest and papers from this *Journal* are listed without abstract. Readers, not in North America, interested in assisting with this very large task, are invited to write Dr. P. F. Bellinger (Dept. of Natural Sciences, San Fernando Valley State College, Northridge, Calif., U. S. A.). Abstractors' initials are as follows:

[P.B.] – P. F. Bellinger	[W.H.] – W. Hackman	[N.O.] – N. S. Obraztsov
[I.C.] – I. F. B. Common	[T.I.] – Taro Iwase	[C.R.] – C. L. Remington
[W.C.] – W. C. Cook	[J.M.] – J. Moucha	[J.T.] – J. W. Tilden
[A.D.] – A. Diakonoff	[E.M.] – E. G. Munroe	[P.V.] – P. E. L. Viette

E. Distribution and Phenology

Caspers, H., "Biozönotische Untersuchungen über die Strandarthropoden im bulgarischen Küstenbereich des Schwarzen Meeres" [in German]. *Hydrobiologia*, vol.3: pp.130-193, 15 figs. 1 April 1951. Includes annotated list of some 95 Lepidoptera from Bulgarian Black Sea Coast. [P.B.]

Castle Russell, S. G., "The scarcity of Rhopalocera in 1951." *Ent. Rec. & Journ. Var.*, vol.64: pp.100-101. 1952. In England.

Castle Russell, S. G., "The New Forest in the 'nineties and after." *Ent. Rec. & Journ. Var.*, vol.64: pp.138-144. 1952. Notes on 50 years' collecting, especially of butterflies. [P.B.]

Castle Russell, S. G., "Collecting notes during the summer of 1954." *Ent. Rec. & Journ. Var.*, vol.67: pp.83-85. 1955. In England.

Castle Russell, S. G., "Phenomenal numbers of Rhopalocera larvae and imagines." *Ent. Rec. & Journ. Var.*, vol.67: pp.111-113. 1955. Records of swarms of *Euphydryas aurinia, Pieris brassicae, Thecla quercus, & Celastrina argiolus,* in Britain. [P.B.]

de Castro, Luis, "*Erebia tyndarus* (ab. *pyrenaica*) Bühl-Heyne, en Barcelona" [in Spanish]. *Bol. R. Soc. Espan. Hist. Nat.*, vol.47: pp.157-159. 15 Jan. 1950. Reared from larva found at 400 m. [P.B.]

Chadwick, C. E., "Abnormal insect numbers – Part 1." *Victorian Nat.*, vol.67: pp.178-183. Jan. 1951. Discusses major fluctuations in abundance of various Australian insects, including *Euploea core corinna* (Danaidae) & *Loxostege affinitalis* (Pyralidae)." [I.C.]

Chalmers-Hunt, J. M., "*Chilo cicatricellus* Hübner confirmed as British." *Ent. Rec. & Journ. Var.*, vol.64: pp.160-161, 1 fig. 1952. Second record, first since 1852. [P.B.]

Chalmers-Hunt, J. M., "The history and status of *Pararge aegeria* (Lep. Satyridae) in Kent." *Entomologist*, vol.85: pp.144-154, 1 map. 1952. Reappearing in Kent after total disappearance (and decline throughout Britain). [P.B.]

Chalmers-Hunt, J. M., & D. F. Owen, "*Nymphalis polychloros* L. (Lep. Nymphalidae) in Kent." *Ent. Gaz.*, vol.4: pp.3-11. 1953. Summarizes known records, from 1828; suggests that species is an immigrant. [P.B.]

Chilson, L. M., "Insect records from Johnston Island." *Proc. Hawaiian Ent. Soc.*, vol.15: pp.81-84. 1953. Records 5 Lepidoptera (Tineidae, Pterophoridae, Noctuidae), only *Achaea janata* being new. [P.B.]

Chneour, A., "Présence on Tunisie de *Danais chrysippus* L." [in French]. *Bull. Soc. Sci. Nat. Tunisie*, vol.6: p.123, 1 pl. 1953. New record for Tunisia; immigrant from south. [P.B.]

Clarke, C. A., "*Melitaea cinxia* L. (Lep.) introduced into Neston, Wirral, Cheshire." *Entomologist,* vol.89: pp.22-23. 1956.

Classey, E. W., "*Diarsia florida* Schmidt (the Marsh Square-Spot)." *Ent. Gaz.,* vol.2: p.71, 1 pl. 1951. Notes on this species. recently discovered in Britain; color figures of adults, including two aberrations. [P.B.]

Classey, E. W., & Barry Goater, "Systematic list of the Lepidoptera taken by the expedition to Ireland." *Ent. Gaz.,* vol.2: pp.95-99. 1951.

Classey, E. W., R. M. Mere, & W. H. T. Tams, "The status of *Hydraecia hucherardi* Mabille in Great Britain (Lep. Noctuidae)." *Entomologist,* vol.89: pp.295-297. [31] Dec. 1956. Article in refutation of theory that moth is a recent arrival. [P.B.]

Classey, E. W., & Hugh N. Robinson, "Burren – 1950." *Ent. Gaz.,* vol.2: pp.87-94, 1 pl., 2 figs. 1951. Account of a collecting trip to this area in Ireland. Color plate of *Luceria virens,* recently discovered there. [P.B.]

Clench, Harry K., "Notes on the occurrence of *Thymelicus lineola* (Hesperiidae) in North America: a summary." *Lepid. News,* vol.10: pp.151-152. 1957.

Clench, Harry K., "Two new records of Pennsylvania Lepidoptera." *Lepid. News,* vol.10: pp.161-162. 1957.

Cleu, Hubert, "Biogéographie et peuplement entomologique du Bassin de l'Ardeche" [in French]. *Ann. Soc. Ent. France,* vol.122: pp.1-74. Dec. 1953. Describes this area in France; gives extensive lists of Lepidoptera & some other groups of insects, indicating for each sp. the sub-regions where it is found & its type of geographic distribution; discusses fauna of individual biotopes, & probable origin of regional fauna. [P.B.]

Cockayne, E. A., "A search for larvae of *Eupithecia actaeata* Walderdorff. and *Eupithecia immundata* Zeller." *Ent. Rec. & Journ. Var.,* vol.64: pp.11-12. 104-106. 1952. Search on *Actaea specata* showed no sign that these spp. exist in Britaon. List of localities of foodplant. [P.B.]

Cockayne, E. A., "A note on *Hymenia recurvalis* Fabricius." *Ent. Rec. & Journ. Var.,* vol.64: pp.71-72, 3 figs. 1952. Identification of new sp. for Britain. [P.B.]

Cockayne, E. A., "The status of *Horisme aquata* Hübner as a British species." *Ent. Rec. & Journ. Var.,* vol.64: pp.73-75. 1952. Probably native, perhaps extinct. [P.B.]

Cockayne, E. A., "*Tathorhynchus exsiccata* Lederer – a noctuid new to the British list." *Ent. Rec. & Journ. Var.,* vol.64: pp.132-133. 1952. Notes on distribution & recognition. [P.B.]

Cockayne, E. A., "*Procus versicolor* Borkhausen in Ireland." *Ent. Rec. & Journ. Var.,* vol.64: pp.347-348. 1952. First record. [P.B.]

Cockayne, E. A., "Abundance of a species on one night only at M. V. light." *Ent. Rec. & Journ. Var.,* vol.66: pp.218-219. 1954.

Cole, A. C., "Insects from Bikini Atoll. Marshall Islands." *Proc. Tennessee Acad. Soc.,* vol.26: pp.246-248. 1951. Records 2 nymphalids & 1 hesperiid. [P.B.]

Comstock, William P., & E. Irving Huntington, "Origins and relationships of Mexican and Antillean Papilionoidea (Lepidoptera)." *An. Inst. Biol.,* Mexico, vol.20: pp.385-391. 1949. Compares no. of genera & spp. in Mexico & Antilles; concludes that latter fauna, which is impoverished & unbalanced, has developed adventitiously & not through any land connection. [P.B.]

Condamin, M., "Lépidoptères rhopalocères du Parc National du Niokolo-Koba" [in French]. *Mém. Inst. Franç. Afrique Noire,* vol.48: pp.197-205. "1956" [Feb. 1957]. List of a collection of Lepidoptera Rhopalocern collected in this national park in Senegal, French West Africa. [P.V.]

Cookson, H., "Notes on some rare butterflies and some sphingids from Southern Rhodesia." *Journ. ent. Soc. southern Afr.,* vol.17: pp.171-174. 1954. Records of 2 nymphalids & 4 lycaenids; list of 27 sphingids taken at light or at flowers. [P.B.]

Cookson, H., "Correction of locality name of new butterflies caught by H. Cookson in 1903, 1904, and 1905, and described by Hamilton H. Druce." *Journ. ent.*

Soc. southern Afr., vol.17: p.265. 1954. Specimens from Katanga wrongly attributed to Rhodesia. [P.B.]

Cramer, H. H., "Die geographiscnen Grundlagen des Massenwechsels von *Epiblema tedella* Cl. Bin Beitrag zur Autökologie des Fichtennestwicklers" [in German]. *Forstwiss. Zentralbl.*, vol.70: pp.42-53, 2 maps. 1951. Describes geographical & altitudinal distribution of sp., & smaller area where it is economically important. [P.B.]

Craufurd, C., "Notes from Aviemore." *Ent. Rec. & Journ. Var.*, vol.63: pp.214-216. 1951. With list of 28 spp. at sugar. [P.B.]

Craufurd, Clifford, "Aviemore in 1952." *Ent. Rec. & Journ. Var.*, vol.64: pp.280-284. 1952. Records Lepidoptera.

Craufurd, Clifford, "Some lamp trap records, 1953." *Ent. Rec. & Journ. Var.*, vol.66: pp.6-8. 1954. In Hertfordshire, England. [P.B.]

Crosby, D. V., "Notes on some eastern Victorian butterflies, with a new Victorian record." *Victorian Nat.*, vol.68: pp.97-101. Oct. 1951. Notes on the occurrence & distribution of several spp., including the first record of *Hesperilla mastersi.* (Hesperiidae) from Victoria. [I.C.]

Cumber, R. A., "Flight records of Lepidoptera taken with a modified Rothamsted light trap operated at Paiaka." *N. Z. Journ. Sci. Technol., Sect. B,* vol.33: pp.187-190. Nov. 1951. Monthly records of captures of 83 spp. [P.B.]

Daniel, Fritz, "Ein Beitrag zur Lepidopterenfauna Steiermarks" [in German]. *Nachrichtenbl. bayer. Ent., Ent.*, vol.4: pp.73-75. 1955. Collecting in Sausal Hills in SE Austria; notes on 40 noteworthy moths (macros). [P.B.]

Daniel, F., "*Zygaena fausta* L. dans les les Alpes et les régions préalpines" [in French]. *Plaquette à la mémoire de Ch. Fischer*: 6 pp. Soc. Ent. Mulhouse. April 1957. Study of this sp. in the Alps & the prealpine countries. [P.V.]

Dardenne, P., "Localité interessante pour les lépidoptères: Cravant (Yonne)" [in French]. *Bull. Mens. Soc. Linn. Lyon,* vol.26: pp.189-190. Sept. 1957. Indication & description of a locality interesting for collecting Lepidoptera, in the Yonne area (central France). [P.V.]

Darlow, H. M., "Additions to the list of the Lepidoptera of Malta." *Entomologist,* vol.83: pp.269-271. 1950. 18 new records. [P.B.]

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Membership in the Society is open to all persons interested in any aspect of lepidopterology. All members in good standing receive the *Journal* and the *News of the Lepidopterists' Society*. Institutions may subscribe to the *Journal* but may not become members. Prospective members should send to the Treasurer the full dues for the current year, together with their full name, address, and special lepidopterological interests. All other correspondence concerning membership and general Society business should be addressed to the Secretary. Remittance in dollars should be made payable to *The Lepidopterists' Society*. There are three paying classes of membership:

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In alternate years a list of members of the Society is issued, with addresses and special interests. All members are expected to vote for officers when mail ballots are distributed by the Secretary annually. There are four numbers in each volume of the *Journal*, scheduled for February, May, August, November, and eight numbers of the *News* each year.

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NOTES ON COLLECTING, REARING, AND PRESERVING LARVAE OF MACROLEPIDOPTERA

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INTRODUCTION

The purpose of this paper is to present a general outline, along with some details, which I have found useful in collecting, rearing, and preserving the early stages of Macrolepidoptera (emphasis is on larvae). The information in this paper is drawn from the author's personal experience in southern California, northeastern Kansas, and western Oregon, unless otherwise indicated. When details are given, these often refer to certain moths, which sometimes have peculiar requirements that make them more difficult to rear than most butterflies.

If more lepidopterists obtained good results from their attempts at larval rearing and preservation, there would undoubtedly be more interest shown in life history studies and similar work. The great advantages in the presevation technique outlined here (using a solution which I call "K.A.A.D.I."), are that (1) no specific time is required in the preserving (or fixing) solution, (2) no changing of solution concentrations is necessary, and (3) the results are excellent. This technique makes collecting and preserving larvae a simple matter, even when travelling by car. However, for best results, it is necessary to follow the technique in ALL its details, from injection of larvae (which is a quick and easy process), to the permanent storage of specimens in the larval collection.

COLLECTING

Beating shrubbery or trees, or sweeping through herbs and grasses with a net, produces a great variety of larvae. It is important to do this both in the daytime and at night, since many nocturnal feeders will be completely off the foodplant during the day, or they will be too low on the stems or branches to be affected by beating. If a certain species is desired, careful searching on the correct foodplant(s) will often produce the best results; again, nocturnal searches should be made as well as

diurnal. A large flashlight or lantern, with a large spot-beam, is the most useful source of light. Searching will give much better results than beating or sweeping, where nest-building larvae are involved. Furthermore, such larvae are usually conspicuous because of the nests they build (*i.e.*, webs, curled or rolled leaves, several leaves drawn together with silk, etc.).

If the adult is diurnal, it is often possible to watch the female ovipositing, or at least to gain clues on where to search for the larvae at some later date. When searching for larvae that feed on a very abundant species of plant, it is often much better to search on isolated plants, or in small clumps, rather than searching in the midst of a large colony of the plant. Where trees are involved, small saplings at the edge of a forest grove, in a field, or along roadsides, will often produce excellent results. When collecting on plants that have stiff, leathery leaves (*i.e.*, various sclerophyllous chaparral plants) it is usually necessary to search during the limited season when new growth is still soft, or when flowers are present. The larvae feeding on such plants often refuse the older (or hardened) growth. An example of this condition is seen in *Quercus agrifolia* (coast live oaks in southern California.); most of the numerous larvae that feed on this tree are present only during that short season (March-April) when the new leaves are growing and tender. These larvae grow rapidly, and most of them will have left the tree by the time the leaves have hardened.

Some pupae may be collected by digging in the soil near or under the foodplant, or by looking under logs, boards, rocks, etc. Other pupae may be discovered in leaf litter that accumulates in the crotches of tree trunks, or around the base of a tree. Some species spin cocoons in bark crevices, or under loose bark. If burlap bags are tied around a tree trunk, certain nocturnal larvae will hide unde these by day, and others may pupate in or under them. Larvae that feed on low-growing herbs may sometimes be attracted to boards placed on the ground, and can be collected in the daytime, when they are hiding under the boards.

Rearing

Whenever possible, it is preferable to rear a species from the egg, as this will provide representatives of all the larval instars, and will show variation within the species. It is a good idea to start with 50 or more eggs, if time and space permit.

Moths will often oviposit readily in captivity. With many, all that is needed is confinement in a box (many saturniids, some sphingids, many arctiids, and others). Many noctuids, notodontids, geometrids, and others will oviposit on strips of stiff (*i.e.* starched) cheesecloth, in a small glass jar. Regular cheesecloth, or strips of paper towel, may be

satisfactory in some cases. Some will oviposit inside of brown paper bags (*Catocala*). Others require sprigs of the foodplant (with fresh leaves), or stems, or bark of the foodplant. These species often require more space (in order to fly around the foodplant) while ovipositing; most butterflies and diurnal moths fit this category, as do some nocturnal moths. Many confined moths will require feeding, as they may only lay a few eggs per night, and will not live long without some liquid. A mixture of one part sugar (or honey) and two parts water is satisfactory for most of those that require feeding. This should be offered to the insect at least every 48 hours, a bit of cotton is saturated with the solution, and the moth or butterfly is placed on the wet cotton-ball. If it does not unroll its tongue to drink, it should be held while its tongue is carefully unrolled with a fine insect pin; when the tongue is touched to the wet cotton, feeding will usually begin. As a more nourishing source of food, for species that must be kept alive for many days (or even weeks) in order to get oviposition, Dr. John G. Franclemont recommends the large, "sticky" Del Monte raisins, which may be soaked in the sugar-water solution. The same wet raisin may be used many times over, as a source of food. (Peculiar requirements for oviposition will sometimes be encountered. The above discussion mentions only the easiest methods, which are successful in numerous cases). Where diurnal species are involved, sunlight is often a requirement, as well as regular feeding, and the presence of fresh sprigs of the foodplant. Means must be devised to provide sunlight without killing the insect from overheat, and the plant material upon which it is to oviposit must be kept from wilting. The container used may be a jar, with cheesecloth covering the top, and a piece of thin white sheet partly shading it. Variations can be worked out to suit the species. Sometimes, small screen cages are better.

Eggs which overwinter are easily kept in good condition if they can be housed in an area with a climate similar to that of the collection site. The jar in which they were laid should be kept outdoors until the following spring, when food is available. They should be kept out of sun or rain, in a covered shed or garage, but exposed to natural OUTDOOR temperatures. Overwintering larvae and pupae are easily handled in the same way. The eggs should not be brought inside until foodplant leaves are well-started. Very young leaves are sometimes sticky, or otherwise unsuitable for small larvae. The eggs should be kept in clean jars, where they were originally laid, and the jar lids should not have holes. Excessive dryness or any condensing moisture in the jar, should be avoided. If the eggs were laid on fresh leaves, the individual leaves with eggs on them should be separated and allowed to dry out somewhat before being

closed up in a jar; if the jar "steams" inside, it should be opened for a short time. As larvae begin to hatch, they may be transferred from the egg-jar to another jar, containing samples of the foodplant leaves, of varying age and tenderness; the remaining unhatched eggs, which are nearly ready to hatch, should NOT be placed among green leaves in a humid jar, or they will often fail to hatch. Small jars with solid lids are best for starting larvae; in these jars, they are easily cared for, and they will not become lost. When larvae are first beginning to feed, they occasionally need to be placed on the leaves several times, or they will wander around and finally starve. A small water-color brush is useful for transferring newly-hatched larvae. If the foodplant is unknown, first try any plant eaten by a related species of moth or butterfly; also, try other plants in the same family as known foodplants. If no clues are available, the following generalization is sometimes helpful, in that it eliminates a great number of plants that one might try: moths that lay "large" eggs, for the size of the moth, nearly always feed upon some woody tree or shrub; those that lay "small" eggs usually feed upon herbaceous plants, weeds or grasses, etc. This phenomenon seems to apply in nearly every case! In offering plants, the following plants, or near relatives, are worth trying in the U.S.A., in addition to others peculiar to certain localities: (a) woody types – *Quercus, Salix, Populus, Ulmus, Juglans* (or other nut tree), *Arctostaphylos, Fraxinus, Alnus, Rosa, Rhus, Ceanothus, Rubus, Ribes, Prunus, Crataegus, Cercocarpus, Cornus, Robinia* (or other woody legume), *Eriogonum, Sambucus, Lonicera, Symphoricarpos, Pinus, Juniperus* (or other conifers), etc. (b) herbaceous types – *Brassica* (or other crucifer), *Mentha* (garden mint), various clovers, *Lotus, Chenopodium, Polygonum, Plantago, Fragaria, Asclepias, Malva, Galium, Penstemon, Oenothera* or *Epilobium* or *Clarkia, Pteridium* (or other fern), *Arctium, Aster, Helianthus,* thistle (or other composites), an annual grass and two or more coarse perennial grasses, etc. The above plants will not, of course, suffice in all cases, but one of them (or a close relative) may often be acceptable. When various plants are tried, only one or two leaves of each type should be offered, to make sure the larvae will be able to crawl over all of them with ease. Tender leaves should be offered, but not extremely young leaves.

As the larvae grow, they may be transferred to larger jars, screen cages, or "sleeves" of netting upon the foodplant (outdoors). At all times ample food should be available, and crowding should be avoided. If disease does not kill overcrowded larvae, the resulting adults are likely to be dwarfed. Half-pint, pint, and gallon jars (wide-mouthed) are suitable for rearing most larvae, unless very large numbers are being reared. Lids without holes should always be used. The obective is to

keep the jar somewhat humid or "steamed" inside, which in turn keeps the foodplant leaves fresh for several days. Jars should be opened to air every day or two. When the larvae are placed on fresh foodplant, the jar should be throughly cleaned under hot water from the tap. An aluminum baking tin is a very useful container into which to dump larvae prior to changing them; if it is about two inches deep, and smooth, it is difficult for them to crawl out, and the tin is readily washed with hot water, after use. When using jars for rearing, it is necessary to pay close attention to conditions in the jar, and to air them out regularly, or disease may develop. Change the foodplant before it runs out, or when the jar becomes too dirty with frass. Rearing-jars should be kept in a well-lighted (but sunless) location, at 70°F., or less. A gallon jar is suitable for about 20 - 50 (depending on size) average noctuid larvae in last instar. In most cases, the jar-technique is convenient and time-saving, and the larvae usually grow rapidly.

Some larvae definitely require sunlight and/or ventilation. Examples of larvae with these requirements are certain arctiids, among which are *Apantesis, Arctia, Haploa, Kodiosoma,* and *Platyprepia;* many saturniids (*Hemileuca., Pseudohazis, Calosaturnia,* and others); many sphingids (after third instar); some lasiocampids; a few geometrids (particularly larger types, such as *Biston* and *Cochisea*); most papilionids; some nymphalids (*Euphydryas* and *Chlosyne*), etc. Such larvae are best kept in screen cages or other ventilated containers. Those that also need sunlight will feed and grow well if this is provided for at least two hours daily. (If necessary, electric lights may be used in place of sunlight.) The foodplant is kept fresh in a small jar or tube of water, which should be plugged to keep larvae from crawling in and drowning. The "sleeve" technique, outdoors on the foodplant, is especially useful when rearing large numbers of one species. Tough nylon or dacron netting makes a good outdoor bag, for use as a sleeve. White bed sheets can also be used; they keep birds from seeing the larvae, and give protection from too much sun or wind.

In handling larvae, those that cling with great tenacity to the plant stems(most sphingids, saturniids, and some geometrids, etc.) should never be forcefully pulled off, or the prolegs will be injured; such larvae may then bleed to death. Any larva that is ready to moult should be left where it is; if dislodged from its silken mat, it may be unable to pull free from its old skin, and will die when moulting is attempted. Larvae about to moult are very easy to recognize because of the swelling of the new head capsule under and behind the smaller old one; such larvae will remain in exactly the same place for two or more days.

Pupation requirements of larvae vary greatly. Among the moths, a

large number of species (especially sphingids, noctuids, notodontids, and some geometrids) require soil, into which they burrow. This must be provided when the larvae stop feeding, and begin to crawl around the bottom of the jar. Three or four inches of damp loam, in a gallon jar, is suitable for 20 or 30 "average" noctuid larvae. A layer of leaf litter, about one inch deep, should be provided on top. The soil should be damp enough that it will not cave in when the larvae burrow into it, but it should NOT be wet. After about 14 days, the pupae should be dumped out, and stored in special containers for pupae, where they will be less exposed to attack by fungi. Other larvae have a very special requirement of soft wood or pith, into which they chew for pupation. Such larvae will die without pupating, if placed on damp soil. (Examples are agaristids and noctuids of certain genera, such as *Alypia, Psychomorpha, Raphia, Behrensia, Pleroma;* notodontids such as *Cerura*). A good material for such larvae is yucca stalk pith, split lengthwise. Also useful are pieces of Celotex, or similar material, or strips of fibrous, stringy bark. Numerous geometrid larvae spin slight cocoons within loosely-curled leaves, either on the ground or on the foodplant. Most saturniids and arctiids, and a few noctuids and others, spin cocoons above ground; such cocoons offer no special problems. The same may be said of most butterfly chrysalids. Naked, underground pupae, that do not emerge for many months (*i.e.,* aestivate and/or overwinter), present problems in keeping them alive during this long period. If kept too damp, they are often killed by fungus, or they rot; if kept too dry, they dry up and die. In general, it is safer to tend toward too dry than too wet conditions; during most of the diapause period, near-dryness in a closed container produces good results. Pupae should NOT be kept in a heated room, or where the air is very dry. When it is time to break the diapause, warmer temperatures and damper soil are usually needed. In general, the safest way to handle over-wintering pupae is to leave them OUTDOORS most of the winter, if they are native to the area, or to another area that has colder (or equally cold) winters; if early emergence is desired, they can be brought inside in late winter, instead of waiting for normal warming outside. Uniform cold, as in a refrigerator, gives very poor results in overwintering pupae; natural fluctuations seem desirable. Ample provision must be made for the emergence of adults, if the pupae are in glass, or other smooth-sided containers. A cheesecloth cover, under the lid, and a strip of cheesecloth leading from the bottom to the lid, are very important, to make certain that the emerging insect can climb up to a position where its wings can hang down as they expand and dry. If such provision is not made, the emerging adult will often be ruined. The cheesecloth should be provided soon after pupation, as one cannot

always tell whether the pupae will go into diapause, or begin to emerge two or three weeks later.

Mr. Christopher Henne of Pearblossom, California, has developed a splendid pupa-container which appears to solve all the problems encountered in keeping pupae alive for long periods of time. Mold and drying out are both prevented, and the pupae remain in excellent condition for months on end. This container includes ample provision for the emergence of adults, and it also has a system for keeping track of numerous different pupae, without getting them mixed up. Mr. Henne has stated that he intends to publish information on this device in the future.

Many very helpful and specific details on caring for larvae and pupae in captivity, are given by Newman (1953).

Preserving

My technique follows Peterson (1959), with a few modifications. The technique gives excellent results with nearly all lepidopterous larvae. Many of the colors are perfectly retained, although blues and greens, which are usually due to the color of the body fluid, are always lost entirely; other colors may be altered somewhat. For this reason, it is desirable to keep a notebook of color descriptions to correspond to all preserved specimens. These descriptions should be made from the living larva before it is preserved. It is also worthwhile to include notes on any distinctive habits or behavior (*i.e.*, resting positions; mode of locamotion; reactions to disturbance; whether or not a nest is built; time of feeding; diurnal or nocturnal, etc.). In describing eggs, color changes should be noted, from the time of oviposition until hatching. In describing a pupa, it should be noted whether or not a glaucous bloom is present, and whether the pupa is capable of abdominal movement, how vigorous this movement can be, etc. If cocoons or earth-cells are constructed, these should be described as to where built, texture, color, and thickness of silk, etc. Many cocoons can be pinned in the dry collection, and are definitely worth saving, as they are often quite distinctive.

The basic solution used in preservation (K.A.A.D.) is as follows:

Kerosene — 1 part
(Use ordinary kerosene obtained at service stations—not highly purified kerosene).
Glacial Acetic Acid — 1 (or 2) part(s)
95% Ethyl Alcohol — 9 parts
Dioxane — 1 part
(Dioxane may be replaced by Iso-butyl alcohol, but more than one part is needed).

Peterson (1959) describes the part played by each ingredient of the solution; knowledge of this makes it possible to modify the basic solution in various ways, in order to achieve good results with all larvae.

I have had such excellent results with the following modified solution, which I call K.A.A.D.I., that I use it almost entirely (for lepidopterous

eggs, larvae, and pupae):

K.A.A.D. (as given above), using 1 part acid – 12 parts.
Iso-butyl alcohol – 3 parts
(Enough must be added to "clear' the' solution, and make the kerosene miscible).
Kerosene – 2 parts
Glacial Acetic Acid – 1 part

A modification in technique, which gives the best results, is to INJECT all pupae, and any larva over one-half inch in length, using a hypodermic needle, on a two cc. hypodermic syringe. (It is well to have all of these sizes of needles on hand: #27, 26, 24, and 22). It is important that the larva be in the proper condition, before it is preserved. Whatever the instar, it should be nearly "filled out" in that particular instar. Poor specimens result from those that have only recently moulted a day or two before, or from larvae that are nearly ready to moult.

The larva should first be killed in the solution; a few minutes later, it should be injected (with the same solution) through the anus, to the extent that all the prolegs pop out. If this causes over-inflation, one small puncture with a No. 000 insect pin, in the thin membrane behind the head, will remedy the situation without letting out too much of the injected fluid. Never inject a larva in more than one place, or puncture it with the needle. The injected larva is then returned to the solution, where it should remain for one or more days. If it is a very large larva (size of a tomato sphinx), it should be left in K.A.A.D.I. for about one week. The timing is not of great importance so long as the larva is not taken out too soon. Only experience will show what timing to use; it may vary from 30 minutes, for some eggs and very small or "thin-skinned" larvae, to one week. Little or no damage results from spending more time than required in the solution.

The same solution of K.A.A.D.I. may be used many times, for quite a few larvae, until it becomes a deep yellow-green; most of it should then be thrown out, and new K.A.A.D.I. is added to the preservation-jar, which must have a Bakelite plastic lid that is not subject to reaction with chemicals in the solution.

After sufficient time in the preservation-jar, the larva is removed to 95% ethyl alcohol, in which it is permanently stored. Nothing less than 95% ethyl alcohol should be used, as larvae fixed in K.A.A.D.I. or K.A.A.D. tend to collapse, and they may eventually discolor internally, if the alcohol is weaker than 95%. It is convenient to have "clean-up jars" of 95% alcohol, in which the larvae are first placed; the alcohol in these jars will become green with larval fluids. The larvae are left in these jars for a week or more; finally, they are placed in clean alcohol (95%) for permanent storage, in homeopathic (patent lip) vials. If the larvae have stayed in the "clean-up jar" long enough, the alcohol in the vial will remain clear. Homeopathic vials are far superior to shell vials, for several reasons:

(1) the stopper fits better; (2) a considerably smaller stopper may be used, reducing surface of stopper exposed to alcohol; (3) an oversize stopper may be forced in (using a No. 1 insect pin to let out air), and this gives a tight seal; (4) the vials don't break easily. Homeopathic vials may be purchased, at a reasonable price, from companies such as Scientific Supplies Company, Division of Van Waters and Rogers, Inc. Ordinary corks are worthless as permanent stoppers, since they eventually break down and shower particles in amongst the specimens, and the alcohol slowly evaporates. Black rubber stoppers are quite unsatisfactory, as they will eventually color the alcohol dark brown, and stain pale larvae; also, these stoppers tend to become stiff, and they may develop cracks. Neoprene stoppers are much more satisfactory. One company which manufactures these gray stoppers is Western Rubber Co., Goshen, Indiana. Neoprene stoppers are low in price and do not discolor the fluid.[1] They are very pliable, and give a good, tight seal. The end exposed to alcohol will swell very slightly, but this is of little consequence.

Labels used in vials with preserved larvae are of 100% rag, typing bond paper. This is thin enough not to damage first instar larvae in the vial, yet it is tough and takes black Pelikan (or India) ink very well.

All stages of one life history (eggs - pupae) can be stored in the same vial, when larval size permits. Otherwise, eggs and early instars are placed in one vial, and the larger larvae (with pupae) in other vials. The stoppers in the vials, as well as the locality and determination labels inside, receive the same number that corresponds to the color description, and also to any reared adults in the dry collection. As to size of homeopathic vial, all of the following sizes are useful: 1, 2, 4, 6, and 8 drams. An 8 dram vial will often hold all the stages of a single species, with enough alcohol for permanent preservation. Placing too many larvae in one vial should be avoided; the alcohol will gradually dilute, and then the larvae will begin to discolor (darken) internally. About one year after placing specimens in permanent storage, it is well to go through all the vials once, and replace all green-tinged alcohol with clean 95% ethyl alcohol.

The techniques outlined above will give excellent results with most larvae and pupae, but various modifications must sometimes be employed for special cases. (Experience will show this). Some larvae, especially skippers for example, should be starved for a day or two prior to preservation, and even then they must be thoroughly injected to prevent internal discoloring.

A method for preserving greens and blues is needed, and would be

[1]They are sold only in boxes of five lbs. of one size, and a minimum order is $10.00.

a significant discovery. For discussion of some other modifications of the K.A.A.D. technique, see Atkins (1958).

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BOOK NOTICE

FOREST LEPIDOPTERA OF CANADA RECORDED BY THE FOREST INSECT SURVEY. Volume 3, Lasiocampidae, Thyatiridae, Drepanidae, Geometridae. Compiled by R. M. Prentice. Publication 1013, Forest Ent. & Pathol. Branch, Canada Dept. Forestry, Ottawa. 260 pp. (numbered 283-543) including 173 maps (figs. 164-337). 1963. Paper.

This is the third in a series of compilations of the forest Lepidoptera of Canada based on data gathered by the Forest Insect Survey. The general operations of the survey and methods of compiling records were outlined in the first of the series. Volume 1, published in 1958 (Canad. Dept. Agric. Publ. 1034) also included records on Papilionidea, Hesperiioidea, Sphingoidea, Saturniioidea, Nolidae, and Arctiidae. Volume 2 (1962, Dept. Forestry Bull. 128) treated the remainder of the Noctuoidea.

The format of the present volume is identical to that of the previous ones, including records on the distribution, hosts, feeding type, relative abundance, and seasonal occurrence of each species sampled. Numbering of pages, figures, and species is consecutive through the series. Some 260 species of the above listed four moth families, all but 13 Geometridae, are treated in volume 3, bringing the total for the three works to 614. *Forest Lepidoptera of Canada* is undoubtedly the greatest wealth of information on the biology and distribution of Nearctic Lepidoptera ever brought together in one publication. Indices to insects and hosts are given for each volume. — EDITOR

TRYON REAKIRT (1844 - ?)

by F. Martin Brown[1]

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Tryon Reakirt has been a mystery man to most entomologists who have tried to learn about him. All that has been known is that during the 1860s he was very active describing butterflies from the Americas and the Philippines. Nine papers written by him appeared in the Proceedings of the Entomological Society of Philadelphia and a tenth paper was published in the Proceedings of the Academy of Natural Sciences of Philadelphia. The last appeared in 1868. From it the reader gets the feeling that others were to follow. They did not.

Carpenter (1945, 1953), in her supplement, gave no dates for him. Her reference to Essig (1931:737) supplies only incorrect information. The statement there that Reakirt "collected Lepidoptera throughout California and more particularly in the vicinities of Los Angles and Sacramento, as well as in the Rocky Mountains.", as discussed below, evidently is utterly false. Carpenter's other reference for Reakirt is to Strecker (1878:262) where the statement is mead "born in Philadelphia, Penna.", and there is a bibliography of his writings. Strecker could have written considerably more about his young friend, but was in a peculiar position as will develop.

Through the courtesy of Dr. Rupert Wenzel and of the director of the Chicago Natural History Museum, I have been allowed to read the letters from Reakirt and from his parents to Strecker. From the 74 items in the correspondence I have been able to construct a brief and incomplete biography of the man.

Tryon Reakirt was the son of John and E. C. Reakirt, born in Philadelphia on April 21, 1844. At the time that he appeared upon the entomological scene he was in partnership with his father and brother Daniel in the importing and wholesale drug business. In 1868 he branched out into business of his own while retaining an interest in the family concern. His new venture was the Delaware Lead Works in Wilmington, Delaware, where he manufactured white lead and later, lead acetate. This new venture during the depressed days that followed the Civil War was his downfall.

Reakirt became a member of the Entomological Society of Philadelphia on July 13, 1863 (Cresson, 1911:56.) At that time he was nineteen years old and apparently a young man of some financial substance. He became well known as a student of the butterflies of the American tropics and of the Indo-Australian region. He also wrote the first summary of our

[1]This paper is a by-product of N. S. F. Grant No. GB-194.

knowledge of the butterflies of the Rocky Mountain region (1866.) This was prompted by the collections brought from Colorado by James Ridings in 1864. In addition to Ridings's collection, Reakirt studied two earlier ones in the cabinet of the Society. These had been made by William Wood and Winslow J. Howard (see Brown, 1957.) W. H. Edwards considered Reakirt the North American rhopalocerist most competent to handle the very large collection of butterflies made by U. S. Minister A. A. Burton while serving in Bogota, Colombia. These had been sent to the Smithsonian Institution (see Brown 1960:163 *et seq.*). It was while publishing upon this collection that Reakirt dropped from the entomological scene.

A single letter in W. H. Edwards' file housed in the archives of the State of West Virginia is the most entomological letter that I have read written by Reakirt. It is brief, so I quote it in entirety to give the flavor of the man.

"W. H. Edwards, Esq. "Philada Jany 26, 1868

"Dear Sir:

"Your favor of the 11th was duly recd: have been somewhat remise in not replying sooner.

"Hübner erected the genus *Doxocopa* in his Sammlung for the species *Idyja*: very appropriately, I think, separating it from the great mass of American and Foreign Apaturidae: from all which its species are readily distinguished by their peculiar facies. H. Schäffer considers it of good value.

"The balance of Amer. Apaturidae, Hübner placed under the name *Catargyria*, reserving *Apatura* for the Old-world species: since then, Boisd. has separated an Indian section, with the generic title, *Castalia*, and more recently Moore has added a fifth, *Dilipa*.

"I have come to the conclusion that *Ausonides* Boisd. Edw. = *Lanceolata* Boisd. It struck me very curiously, that out of the thousands recd from Cala I have never obtained the latter: so I compared descriptions carefully, and believe them to be synonymous.

"Did Grote bring back much of a collection with him?

"Very truly
/s/ Tryon Reakirt"

Reakirt's collection ultimately was incorporated with Strecker's and now constitutes a considerable portion of that collection in the possession of the Chicago Natural History Museum. The first letter from Reakirt in the Strecker correspondence is dated November 22, 1866, and apparently was written soon after the two had met. In it he announced that he was expecting a shipment of 1,000 specimens "of Philippines, Moluccan and Californian" butterflies. These he appearently had purchased from Lorquin. During the period 1866-1868 Reakirt employed Strecker to mount much of the material that he was receiving. There is no indication in these letters that Reakirt himself did any extensive field collecting.

In the summer of 1868 Reakirt founded "Tryon Reakirt & Co." and the Delaware Lead Works. That summer he turned over to Strecker his butterfly collection to be sold to raise additional funds. The original

price was set at $1,800. For some months Strecker held the collection under agreement to sell it for the owner. Meanwhile Reakirt entered into negotiations with the New York Lyceum (later the American Museum of Natural History) for purchase of the collection. In October, 1869, he was informed that the funds necessary could not be raised. Then he offered the collection to Strecker for the Reading Natural History Society for $1,400 plus $46 that Strecker owed him. This deal fell through and Strecker agreed to purchase the collection for the same sum. A timetable of payments was arranged, but Strecker made none of the stipulated payments. Meanwhile Reakirt was in serious financial trouble. Correspondence between the two men stopped with a letter from Reakirt dated August 18, 1870.

Early in 1871 Reakirt disappeared. He fled the country. The first letter giving an indication of this is one written by John Reakirt, Tryon's father, on February 17, 1871. The letter is cryptic. Mr. Francis J. Lederer, Chief County Detective in the District Attorney's office in Philadelphia, gave me the leads that allowed an understanding of the case. Both John Reakirt & Company and Tryon Reakirt & Company were forced into involuntary bankruptcy by action taken in the U. S. District Court for Eastern Pennsylvania on February 18, 1871. (Docket 5, cases 1310 and 1311.) These cases dragged out beyond the death of John Reakirt, and possibly Tryon, and finally were closed in June, 1879. This is the reason that Strecker said so little about Reakirt in his note, published in 1878.

When Tryon Reakirt fled from the United States he went to Lima, Peru. In exchange for acting as a mail-drop, to keep Reakirt's place of hiding secret, and for later acting as an investment agent for him, Strecker was relieved of making payments beyond the token ones he had made for Reakirt's collection. He earned it!

Reakirt resumed correspondence with Strecker by a letter dated June 11, 1871, mailed at Lima, Peru. Altogether Strecker received eleven letters from the exile. In these Reakirt used the name Theodore Rand. At one time Strecker was approched to procure a passport for Reakirt in the original spelling of his family name — T. Thomas Reugert. Inquiry at the U. S. State Department and the National Archives produced no application in that name. Other letters to Strecker inquire about countries without extradition treaties with the United States. Still others set up a system by which Reakirt could invest money in the New York Stock Market through Strecker.

The last letter addressed to Strecker from Reakirt was written sometime in the fall of 1872. The envelope is empty, the postmark removed but a face stamp "London 30 Nov 72" indicates that it had been transshipped then. In letters to Strecker there were some hints that Reakirt would move to Rio de Janeiro. There also was the information that he was

suffering from dysentary. Nothing further is known about Tryon Reakirt.

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TWO SPECIES OF HESPERIIDAE PREVIOUSLY UNRECORDED FROM THE UNITED STATES

by J. W. TILDEN

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Two species of Hesperiidae (Hesperiinae) described from Mexico and previously unrecorded north of the Rio Grande were collected by the author in the vicinity of Brownsville, Cameron County, Texas, during October and November, 1963.

Vidius perigenes (Godman) was first taken on October 20 and for several days thereafter; the last specimens were somewhat worn. The length of the forewing costa of the male is 12-13 mm, that of the female 14-16 mm. The upper surface of the wings is dark brown without spots, the costa of forewing and the fringes, lighter. The fringes are not checkered. The underside of the forewing costa and apex, and the entire hindwing, are cinnamon colored with light veins. On the hindwing there is a pale ray that runs the length of the wing at the upper edge of the discal cell. The genitalia are figured by Exans (1955). The figure of the valve is recognizable. That of the uncus is inaccurate, showing the cleft too wide, the lateral lobes too flaring and the lateral processes too large.

This species was taken in tall grass growing in the open, usually along ditch banks and railroad rights-of-way. Often the insects hid in the thick clumps or took refuge near the bases of the culms. *V. perigenes* was not seen to visit flowers nor to choose open perches. It is therefore easily overlooked.

Lerodea dysaules Godman was first taken October 17 and the last captures were November 13. These are the first and last days of the

author's collecting in the Brownsville area. Presumably the insect was on the wing before and after these dates, indicating a long flight season. *L. dysaules* somewhat resembles *L. arabus* (Edwards) but differs in a number of ways. *L. dysaules* is a small insect (forewing costa 11-14 mm), dark grayish-brown, with reduced white markings on the forewing and no white markings on the hindwing. The coloration below is dull, quite gray, and a short band, often only perceptibly darker than the ground color, extends from space Cu_2 towards the costa, on the hindwing. This band is about 2mm wide and may be pale-edged. The insect appears gray rather than brown, and the fringes are obscurely checkered. *L. arabus* is by comparison a more brownish insect, and lighter in coloration. The forewing measures slightly larger (about 15mm). The white markings of the forewing are more extensive. There is usually a band of white spots on the hindwing as well. On the pale under surface of the hindwing is a conspicuous dark brown patch. The fringes appear uncheckered, though close examination may show a few dark scales at the vein-ends of the fore-wing. It will be seen that the type of markings is very similar in each instance. However, the overall effect is quite different and the two do not look very similar when compared.

Bell (1938) and Lindsey, Bell & Williams (1931) consider *L. dysaules* a synonym of *L. arabus*. Evans (1955) treats each as a separate species but notes that *L. dysaules* may be a subspecies of *L. arabus*. Rindge (1948) records a specimen from Pulpito, Baja California, as *L. arabus*. MacNeill (1962) treats this specimen and another from Cabo San Lucas as *L. dysaules*, but points out that the Pulpito specimen would key to *arabus* in Evans' key, while the Cabo San Lucas specimen would key to *dysaules*. He also notes that he sees no genitalic differences between these two specimens.

MacNeill's description of the Pulpito specimen suggests that it is referable to *L. arabus*, especially the statement that it ". . . has the large hyaline spots fully developed on the forewing, with distinct traces of a pale band of spots above and below on the hindwing. . . ." His finding that the genitalia of the two specimens are identical is very interesting. Evans' figures show considerable difference between the valvae of the two entities. The valve of *L. arabus* has a V-shaped cleft, the ventral projection somewhat longer than the dorsal one. The figure of Skinner and Williams (1923) agrees. Evans' figure of *L. dysaules* shows a U-shaped cleft of the valve, with both the dorsal and ventral projections long and slender. The genitalia of the specimens from Brownsville, reported here, agree with Evans' figure. The one male *L. arabus* available to me for genitalic examination has the cleft less markedly V-shaped than shown in Evans' and Skinner and Williams' figures. The dorsal arm is short and bent toward the midline.

The figures by Godman and Salvin (1900) are good likenesses of the Brownsville specimens. The author has shown some of these Texas specimens to two lepidopterists' who know *L. arabus*. Neither identified these specimens as *L. arabus*. This is mentioned in support of the statement that *L. dysaules* and *L. arabus* have rather different facies.

One of the problems in reaching a decision as to the status of *L. arabus* and *L. dysaules* is the scarcity of specimens. Evans had before him two *dysaules* from Guererro, Mexico (1♂, 1♀). He had only a single male *arabus*, from Arizona. Evidently MacNeill had only the two specimens. The Brownsville specimens of *L. dysaules* number nineteen in all, but are from Cameron County, Texas, only. Five *L. arabus* have been examined, but only one of these is in the collection of the author, a ♂ from Sabino Canyon, Pima County, Arizona.

Any decision to consider *L. dysaules* and *L. arabus* separate species, or to consider *L. dysaules* Godman, 1900, a subspecies of *L. arabus* (Edwards, 1882), should be deferred until such time as more material is available. The two seem to be allopatric, suggesting that they may be subspecies of one species. The genitalic similarity also suggests close relationship if not conspecificity. However, they do differ considerably in appearance, and (possibly because of the few specimens) intergrades seem to be lacking.

The majority of specimens of *L. dysaules* were taken under the canopy of the thorn forest, sitting on the grass or the ground, and in the shade. A few were taken in the open, early in the morning or late in the day, around Bermuda Grass (*Cynodon dactylon* (L.) Pers.).

Specimens of both *Vidius perigenes* and *Lerodea dysaules* will be placed in the following institutions: The American Museum of Natural History, New York; The California Academy of Sciences, San Francisco; The Carnegie Museum, Pittsburgh; The Los Angeles County Museum, Los Angeles, and the United States National Museum, Washington, D. C.

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BUTTERFLIES OF YAKIMA COUNTY, WASHINGTON

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Yakima County, Washington, is rather unique as an area for the study of butterflies. It is quite large, 4,273 square miles, and it encompasses every life zone from Arctic-alpine to Upper Sonoran. The elevation ranges from over 12,000 feet on Mt. Adams to 500 feet at the Columbia River. Annual precipitation ranges from 60 inches or more in the mountains to about 6 inches at the Columbia River.[1]

The physiographic diversity results in a wide variety of vegetation, from stunted conifers, low shrubs and fields of wild flowers at timber line down through the heavy growths of white pine and fir, open yellow-pine forests, a belt of oaks (*Quercus garryana*), and on down to open fields and dry desert characterized by sage-brush, greasewood, hop sage and a few early annuals. The floral range enables a large number of species of butterflies. It brings together in one county such northern species as *Erebia discoidalis, Agriades glandon* and *Carterocephalus palaemon* with southern species such as *Apodemia mormo* and *Heliopetes ericetorum*. Of about 130 species that have been recorded in Washington, at least 103 occur in Yakima County. These facts have made it worth while to study the butterflies of this county intensively, which I have done for seven years. I also had taken a few notes on species seen in the 1920's; and the Rev. A. I. Good collected in the county in 1955-56, and he has very kindly given me copies of his records.

As shown on the accompanying map, Yakima County is bounded on the west by the Cascade Mountains. From them flow the American and Tieton Rivers which run into the Naches River and thence into the Yakima River. Umtanum, Wenas, Cowiche, Ahtanum, Toppenish and Satus Creeks also flow into the Yakima River, which has an elevation ranging from 1400 feet at the north boundary of the county to 650 feet at the south. Thus we have a series of rather shallow canyons opening into the wide valley. A small portion of the northeast boundary of the county borders on the Columbia River.

A firing range, operated by the U. S. Army, occupies 250 square miles of desert land, and is "off limits" as is the portion of the Yakima Indian Reservation west and south of Toppenish Creek, an area of 1500 square miles. An exception to this is a strip along Satus Creek where U. S. Highway 97 runs through the reservation. The area between Fort Simcoe

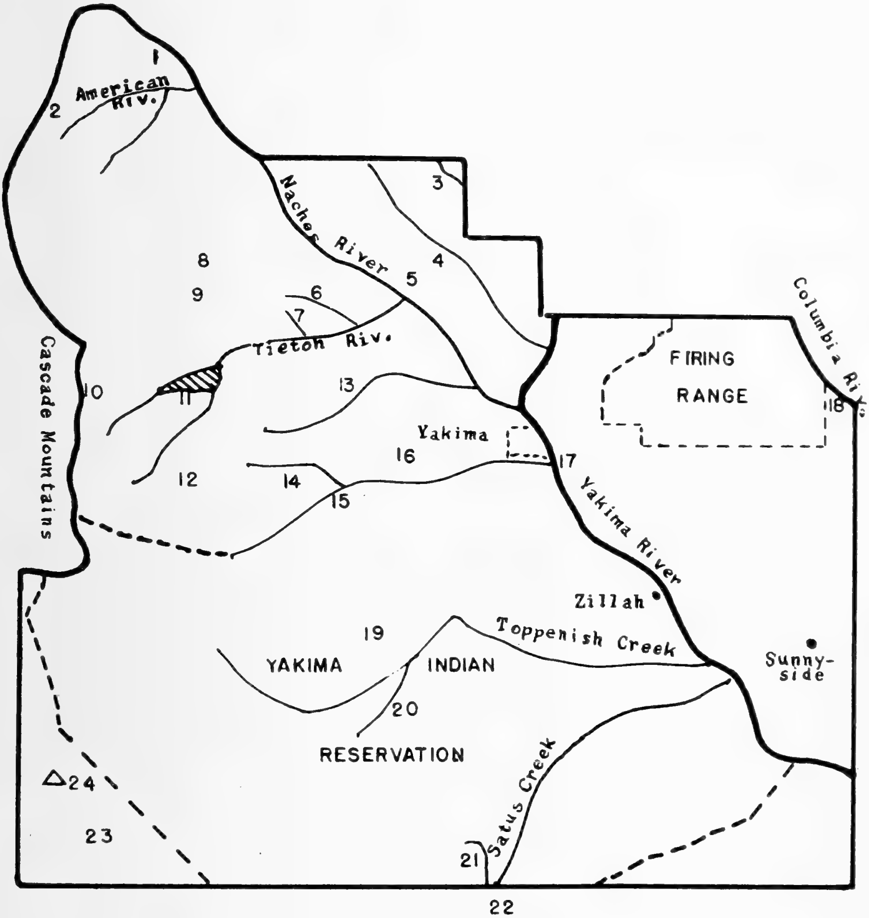
[1]There are several counties in western Washington with even greater ranges of elevation, but they do not have the range of life zones nor of precipitation that occur in Yakima County.

and the Yakima River, most of the area east of the river, and some land north and west of Yakima is either irrigated farm and orchard land or very dry desert. Collecting in either is not good, the irrigated land because of cultivation and the repeated use of insecticides, and the desert land because of lack of moisture and vegetation. So there remains somewhat less than half the total area where collecting is potentially good.

Sites where most collecting has been done are marked on the map as follows:

No.	Designation	Elevation
1	Little Naches	3,000
2	Cascade Crest Trail	5,000-5,200
2	Sheep Lake	5,500
3	Umtanum Creek	2,800
4	Wenas Creek	2,000
5	Mt. Cleman	5,000
6	Oak Creek	2,500-3,500
7	Bear Canyon	2,500-3,500
8	Timberwolf Mountain	6,000
9	Bethel Ridge	6,000
10	Hogback Mountain	6,500
11	Rimrock Lake	3,000
12	Blue Slide Lookout	7,000
12	Short & Dirty Ridge	7,000
12	Cultus Hole	6,000
12	Nasty Creek Flat	5,500
13	Cowiche Creek	2,500
14	Antanum Creek	2,000-3,000
15	Tampico	2,000
16	Cottonwood Creek	2,000
17	Moxee Valley	950
18	Priest Rapids	500
19	Fort Simcoe	1,200
20	Mill Creek	1,800
21	Kusshi Creek	2,000-2,500
22	Satus Pass	3,200-4,000
23	Bird Creek	3,000
24	Mt. Adams	12,300

Satus Pass is actually about 5 miles south of the county line, but it is the same type of terrain as in the Indian Reservation to the northwest; and it affords the only access to this area at an elevation above 2,500 feet. No collecting has been done on Mt. Adams above tree line at about 7,000 feet, and collecting there is very poor. The best sites are in Bear Canyon (Newcomer, 1962), along Oak and Kusshi Creeks, in the vicinity of Satus Pass and along the Cascade Crest Trail. Many of the sites in the mountains are accessible over Forest Service and logging roads. One of them, Hogback Mountain, is accessible by chair lift. U. S. Highway 97 goes over Satus Pass, and then north along the Yakima River. U. S. 410 follows the Naches and American Rivers



EXPLANATION OF MAP

Yakima County, Washington; collecting sites indicated by numbers 1-22, as enumerated in text.

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to the summit of the Cascades at Chinook Pass. State Highway 14 follows the Tieton River past Rimrock Lake to the summit at White Pass.

The nomenclature used in the following list is that of Ehrlich and Ehrlich (1961), modified according to dos Passos (1964). Many of the species have been determined by specialists: *Colias* by Klots, *Cercyonis* by F. M. Brown, *Speyeria* by Grey, *Euphydryas* by Jewett, the green *Callophrys* by Clench, and some of the skippers by Burns and MacNeill. I am greateful to these men for help with these genera. Subspecies are mentioned if the distribution patterns involved are of interest in discussion of the Yakima County area. Elevations are given in feet. Larval food plants are given where known, using the nomencla-

ture of Abrams (1944, 1951) and Abrams and Ferris (1960).

1. *Parnassius clodius* Men. Occurs commonly in open meadows and mountain slopes, 4000-7000; July to September.

2. *Parnassius phoebus smintheus* Dbldy. Flying with *clodius*, but also taken in Bear Canyon (2500′), late May and early July, and on north fork of Ahtanum Creek. Earlier occurrence in Bear Canyon apparently due to lower elevation. Its food plant, *Sedum*, is abundant there.

3. *Papilio multicaudata* Kirby. Not common but occurs in the canyons at 2000-3000′, and also at Priest Rapids at 500′; May to August. Larvae on chokecherry (*Prunus demissa*).

4. *Papilio eurymedon* Lucas. Habitat same as last, except not seen at Priest Rapids; May to July. Food plant, *Prunus demissa.*

5. *Papilio rutulus* Lucas. The commonest *Papilio*, occuring in the open valleys and up to at least 6000′, but often absent at higher elevations; May to September. At times very numerous in the city of Yakima. Larvae on willow and cottonwood.

6. *Papilio zelicaon* Lucas. At all elevations from 500′ at the Columbia River to over 6000′ in the mountains; late March to end of May below 2000′, June at 3000′, and July at 4000-6000′. Larvae on wild parsley (*Lomatium grayi* and *L. triternatum*) and on *Pteryxia terebinthina.*

7. *Papilio indra* Reak. This sometimes scarce species flies in April and May in the canyons at 1500-3000′, and has been taken along the Columbia River at 500′. Seen at higher elevations as late as July. Males at times numerous at damp, sandy spots along creeks; females scarce, taken occasionally on flowers. Larvae on *Lomatium grayi.*

8. *Papilio bairdii oregonius* Edw. Occurs commonly along Columbia River below Priest Rapids where its food plant, tarragon (*Artemisia dracunculus*)[1] grows; also in Yakima River Canyon above Yakima. Adults feed on thistle blossoms[2]. Apparently *oregonius* thrives only where thistles and tarragon are growing near each other. Evidently two brooded, as it has been taken in June and again in August and September. Larvae parasitized by the braconid, *Apanteles lunatus* (Pack.).

9. *Colias alexandra* Edw. This northern or high-elevation species occurs sparingly in Yakima County. Noted at Kusshi Creek (2000′), May; Satus Pass (3700′), June and July; Short and Dirty Ridge (7000′), August. Oviposition on a rattle – weed (*Astragalus serotinus*).

10. *Colias occidentalis* Scud. Common along the creeks at lower elevations, May to August; occasional at 6000′. Oviposition on white sweet clover (*Melilotus alba*), vetch (*Vicia angustifolia*) and a lupine.

1Abrams and Ferris (1960) consider *dracunculoides* Pursh. to be the same as the Eurasian *dracunculus* Linnaeus.

2Three species of thistles, *Circium vulgare, C. undulatum* and *C. edule* which might attract this butterfly, occur in this region.

11. *Colias eurytheme* Bdv. Common in clover and vetch fields in the valley, along creeks and sometimes at elevations of 6000′; April to October.

12. *Anthocaris sara Bdv.* Flies from early April to early June in open fields and lower creek bottoms from 500 to 3000′; also taken along Cascade Crest Trail (5000′) in July and August. Females usually yellow, but white ones have been taken on Satus Creek.

13. *Euchloe ausonides* Lucas. Found at same times and places as the preceding but only below 3000′.

14. *Euchloe creusa* Dbldy. Same times and places as *ausonides*, and not always easily distinguishable from it.

15. *Pieris rapae* (L.) At times very numerous in the valley, also occurs at higher elevations, Bird Creek Meadows (6000′) and Short and Dirty Ridge (7000′); March to October.

16. *Pieris napi marginalis* Scud. Bird Creek (3000′) June 26.

17. *Pieris beckeri* Edw. Fairly common at 500-3000′; April to early July, and occasionally August.

18. *Pieris sisymbrii* Bdv. Late March through May at 500 to 3000′; also found on Nasty Creek Flat (5500′) and Short and Dirty Ridge (7000′) in July.

19. *Pieris occidentalis* Reak. Occurs sparingly along Cottonwood Creek (2000′) and in Bear Canyon (2500′) but more commonly in the high meadows at 4000-6000′; July and August.

20. *Neophasia menapia* (Feld. & Feld.) This species has been quite scarce in the mountains northwest of Yakima, and the few specimens seen may have been strays from west of the summit. However, I am told by Indian Service foresters that at times it is numerous enough in the western part of the Yakima Indian Reservation to damage the yellow pines.

21. *Danaus plexippus* (L.) Very scarce in Yakima County although milkweed is common. Apparently breeds here, the few seen being fresh specimens. Cottonwood Creek (2000′) in July and August, and one in Yakima, July.

22. *Coenonympha tullia ampelos* Edw. Taking the season as a whole, this is the commonest butterfly found at all elevations; April to September. Quite variable.

23. *Cercyonis pegala ariane* (Bdv.) Found along Cowiche, Cottonwood, Oak and Mill Creeks and in Tieton and Bear Canyons; late May to September.

24. *Cercyonis silvestris* (Edw.) Found at the same places, July and August, and not especially common.

25. *Cercyonis oetus* (Bdv.) The commonest *Cercyonis;* at the same

places and elsewhere; June to August.

26. *Erebia epipsodea* Butler. The moist, grassy meadows which this species frequents are scarce in Yakima County, and it has been taken only along Oak Creek (2500′), near Rimrock Lake (3000′), American River (3000′) and on Bethel Ridge (6000′); late May through June.

27. *Oeneis nevadensis* (Feld. & Feld.). Quite common in even numbered years, 2500 to 7000′; late May to August. Males along open stream beds and both sexes in fairly dry meadows and on mountain slopes. A single specimen, Little Naches River, July 13, 1959, and one at Sheep Lake, August 28, 1963.

28. *Speyeria cybele leto* (Behr). Not common but occurs along Cowiche and Oak Creeks and in Bear Canyon at 2500-3500′; late July to early September. Adults feed only on thistles.

29. *Speyeria mormonia washingtonia* (B. & McD.). A high elevation species, taken in mountain meadows at most localities above 4000; July to September.

30. *Speyeria atlantis dodgei* (Gunder). Taken only at Satus Pass (3700′) and Cultus Hole (6000′); July and August.

31. *Speyeria egleis* Behr (ssp.). Three specimens, Cultus Hole (6000′), August 11.

32. *Speyeria callippe semivirida* (McD.). Along streams and in high meadows, 1800-7000′; May to August; but only worn specimens after June.

33. *Speyeria zerene garrettii* (Gund.). Mostly at 4000-6000′; July and August.

34. *Speyeria coronis simaetha* dos Passos & Grey. The commonest species. Found from mid-May to September at 1800-7000′. Seen occasionally in Yakima (1000′) and at Priest Rapids (500′), these probably strays. Evidently more than one brood.

35. *Speyeria hydaspe sakuntala* (Skinner). Common at 4000-7000′ and occasionally lower; mid-July to September.

36. *Boloria selene* (Schiff.). Discovered in 1963 by David McCorkle in a sphagnum bog in the Moxee Valley (950′) near Yakima River. Not otherwise known in Washington except west of Oroville (Carney, 1961), which is more than 150 miles north of Yakima; but probably occurs elsewhere in the state very locally. Three broods, one in May, one in late July and one in late August and early September. Larvae on *Viola nephrophylla*.

37. *Boloria titania rainieri* (B. & McD.). A high elevation species, 4000-7000′, in meadows and on open slopes; July to September. Larvae on *Viola* sp.

38. *Boloria epithore* (Edw.). Common and at somewhat lower

elevations than the last; 3000-6000′, in moist, grassy places where violets are growing; June to August.

39. *Euphydryas editha* (Bdv.). A high elevation species, in meadows and on mountain ridges, 5000-7000′, particularly on Timberwolf Mountain; late May through July.

40. *Euphydryas chalcedona colon* (Edw.). A lower elevation species, May to July at 2000-4000′ and occasionally higher. Particularly abundant along Umtanum Creek and near Satus Pass, June and July. Larvae on *Penstemon subserratus* and snowberry (*Symphoricarpos albus*).

41. *Chlosyne palla* (Bdv.). Along creeks at 1800-3000′; April to July. Also near Satus Pass and along Cascade Crest Trail at 3500-5500′, July.

42. *Chlosyne hoffmanni manchada* Bauer. This recently named subspecies (Bauer, 1959) seems to occur in Yakima County only in Bear Canyon, along Oak and Umtanum Creeks at 2000-3000′, and also at Satus Pass, and at Sheep Lake (5500′). Particularly common some years in Bear Canyon on blossoms of woolly sunflower (*Eriophyllum lanatum*). Eggs have been obtained but food plant not yet known.

43. *Phyciodes mylitta* (Edw.). Common everywhere up to 4000′; April to September.

44. *Phyciodes campestris* (Behr). Less common than *mylitta* and mostly at 3500-7000′; July and August.

45. *Nymphalis antiopa* (L.). Hibernating adults flying as early as late March and others all summer; mostly along creeks at 1000-3000′.

46. *Nymphalis milberti* (Godart). Also hibernates and seen in April and throughout the summer, but mostly at 3000-7000′. Very abundant some years at Sheep Lake (5500′) in August and September.

47. *Nymphalis californica* (Bdv.). Very scarce in 1957-59, but abundant since then; March to September, 2000-6000′.

48. *Polygonia faunus* (Edw.). A high elevation species, 3500-6000′; June to September; most common in the fall.

49. *Polygonia satyrus* (Edw.). At low elevations along creeks, April to July, and also on Bird Creek (6000′) and Short and Dirty Ridge (7000′) in July. Larvae on nettle.

50. *Polygonia zephyrus* (Edw.). Evidently has two broods, taken in April at 2000′ and in mid-July to September at 3000-6500′. Larvae on wild currant (*Ribes cereum*).

51. *Vanessa atalanta* (L.). Very scarce; only three taken in seven years; Ahtanus Creek, May 23, 1959, Oak Creek, June 24, 1960, and Priest Rapids, August 23, 1961. May be only a migrant.

52. *Vanessa virginiensis* (Drury). A single fresh specimen, Priest Rapids, August 27, 1961.

53. *Vanessa cardui* (L.). Quite common in 1957-58, but very scarce

since. At all elevations, May to October.

54. *Vanessa carye* Hbn. Taken in Yakima and along Ahtanum Creek in 1958 and in earlier years. Not seen since then.

55. *Limenitis archippus* (Cramer). Seems to occur only in lower Yakima Valley north and east of Zillah; worn specimens in September. Larvae on willows.

56. *Limenitis lorquini* (Bdv.). Common, 1000-6000′; June to September. Native food plants are willow, cottonwood and wild cherry, but larvae sometimes defoliate young apple trees.

57. *Chrysophanus titus* F. Very scarce; taken only on Cottonwood Creek (2000′) in July.

58. *Satyrium fuliginosum* (Edw.). Usually at high elevations, 3500-7000′; July; but also taken on Cottonwood Creek (2000′) in June.

59. *Satyrium behrii* (Edw.). Extremely common along creeks and in nearby desert areas, 2000-3000′; late June to September. Often found flying about antelope brush (*Purshia tridentata*), one of its food plants.

60. *Satyrium saepium* (Bdv.). Not common but found where *Ceanothus* grows at 2500-3500′; June and July.

61. *Satyrium sylvinus* (Bdv.). Along lower creeks near willows; especially abundant on Cottonwood Creek (2000′) in July.

62. *Satyrium californica* (Edw.). Fairly common in canyons, 2000-3000′; July; and near Satus Pass.

63. *Callophrys fotis* (Strecker). In Bear Canyon on sunny days in April, when there is still a skiff of snow in the shade, this inconspicuous little butterfly will be found sunning itself along the warm, rocky slopes. One adult taken at Kusshi Creek, April 22, and a worn specimen, Cascade Crest Trail, July 21. Larvae on *Sedum*.

64. *Callophrys augustinus iroides* (Bdv.). An early flying species, taken in April and May in lower canyons, in early June at Satus Pass (3500′).

65. *Callophrys eryphon* (Bdv.). Also an early flier, April to June, in canyons; common along Kusshi Creek. Adults on an annual composite, spring gold (*Crocidium multicaule*), and on nearby young yellow-pine trees, on which the larvae feed.

66. *Callophrys spinetorum* (Hew.). Not common; Oak Creek, Bear Canyon, Satus Pass (2500-3500′); late June and July. Most often feeding on flowers near pine trees on which mistletoe (*Arceuthobium*) is growing.

67. *Callophrys sheridani newcomeri* Clench. This recently described subspecies (Clench, 1963) emerges on the earliest warm days; Fort Simcoe, Mill Creek, Satus Creek, Bear Canyon; March 31 to early

May; 1200-3000′. One on Mt. Cleman (4000′), May 26. Often on blossoms of *Lomatium grayi* and *Eriogonum.*

68. *Callophrys dumetorum* (Bdv.) ssp. Not definitely recorded in eastern Washington prior to Clench (1963). Leighton (1946) records it, but some of his determinations are erroneous; specimens he lists from Alta Lake are surely *affinis* and others may be subspecies of *sheridani. C. dumetorum* flies later than *sheridani* and has been taken mostly along Kusshi Creek. May 11 to June 18 (2000-2500′), on blossoms of narrow-leaved parsley (*Lomatium triternatum*), and near Fort Simcoe, May 28-June 3, on *Eriogonum;* also at Satus Pass, May 14 to June 18 (3000′).

69. *Strymon melinus Hbn.* Common in the Yakima Valley, where there is considerable acreage of hops and beans; evidently two or three broods; taken from April 2 to September 24 at most elevations from 500′ at Priest Rapids to 2800′ at Umtanum Creek.

70. *Lycaena rubidus* (Behr). Not common; along Cottonwood Creek from mid June to mid July; both sexes on blossoms of *Eriogonum elatum* and other flowers. Also taken in a draw along Ahtanum Creek and on lower Ahtanum Creek south of Yakima. Reported from Tieton by Leighton (1946). Oviposition observed on *Rumex salicifolius* which grows in nearby meadows.

71. *Lycaena heteronea* Bdv. The commonest *Lycaena,* flying with *rubidus,* and in many other locations, June to September, at 2000-6000′; in Bear Canyon from June 22 to September 4, 1962, indicating that there is more than one brood. Eggs on *Eriogonum.*

72. *Lycaena mariposa* Reak. A high-elevation species, taken at 4000-7000′ on mountain sides, in open forest meadows and along creeks; July to September.

73. *Lycaena nivalis* (Bdv.). This variable species may be found at 2000-7000′, usually along creeks; sometimes very common. The females are ordinarily very dark above, often with no trace of the orange or fawn color typical of the species. The description of the Colorado subspecies *browni* fits our material very well. At Satus Pass, oviposition observed on *Polygonum douglasii,* the primary food plant. One brood, although taken from late May to early August at different elevations.

74. *Lycaena helloides* (Bdv.). Fairly common at all elevations; May to September.

75. *Plebejus acmon* (W. & H.). A common species at all elevations below 6000′; April to September.

76. *Plebejus melissa* (Edw.). Not as common as the last, but at the same elevations throughout the summer.

77. *Plebejus argyrognomon* Bergs. July to September at 5500-7000′. Fits Comstock's description and figures of *anna.*

78. *Plebejus saepiolus* (Bdv.). Taken at 2000-6000′, June and July, mostly along creeks, particularly Oak Creek and the Little Naches River. Females invariably dark.

79. *Plebejus icarioides* (Bdv.). One of the commonest blues; at all elevations from 500′ at the Columbia River to 7000′ on Short and Dirty Ridge; late April to August.

80. *Agriades glandon* (Prunner). This species could only be expected at high elevations. One taken on Hogback Mountain in August at 6500, and one at Blue Slide Lookout in late July at 7000. It is suspected that both had flown or been blown over from the nearby Goat Rocks, where the elevation goes to over 8000.

81. *Glaucopsyche lygdamus* (Dbldy.) A common blue at 1000-7000′; late April to June at lower elevations, and July at 5000-7000′.

82. *Phaedrotes piasus* (Bdv.). Not especially common, but occurs at 1000-2000′ along the Ahtanum, Toppenish, Satus and Wenas Creeks; April to June.

83. *Philotes battoides oregonensis* B. & McD. At the lower elevations, 500-2500′; May and June.

84. *Philotes enoptes columbiae* Mattoni. Commoner than the last, and apparently has two broods; the first taken at 1000-3000′ from mid-April to late June; and a second in July. These two species are much alike; *battoides* tends to be smaller and with larger black spots beneath, but examination of the genitalia affords the only sure identification.

85. *Everes amyntula* (Bdv.) An early flier in Yakima County, having been noted from late April to mid-June at 1000-5000′.

86. *Celastrina argiolus* (L.). Another early species; late March to mid-June along the creeks at 1000-3000′. Two forms occur, one typical of ssp. *echo* and the other with the dark markings as in ssp. *lucia,* and both may be taken at the same place on the same day.

87. *Apodemia mormo* (F. & F.). This species is common at certain places in Yakima County, and it occurs elsewhere in Washington and also in Oregon. Its food plant, *Eriogonum,* is abundant in this area, and the adults favor the blossoms of *E. elatum* and of the rabbit brush (*Chrysothamnus nauseosus*). One brood, late August and September, mostly at 500-2000′; at Priest Rapids, Tampico, Mill Creek and Satus Creek; but also in Bear Canyon at 3000′.

88. *Epargyreus clarus* (Cramer). One seen in Yakima, July 19, and also reported in the town of Sunnyside.

89. *Thorybes pylades* (Scud.). Fairly common along the creeks at 1000-3500′; May to July. Oviposition observed on *Hosackia decumbens.*

90. *Pyrgus ruralis* (Bdv.). Taken mostly along Cascade Crest Trail and at Sheep Lake (5500′), July; but also on Little Naches and in Tieton Canyon, June.

91. *Pyrgus communis* (Grote). Occasionally seen along the creeks at 1000-3000′; April to September; and in Yakima in October.

92. *Heliopetes ericetorum* (Bdv.). This species has a primarily southern distribution, but it is seen every year in Yakima County and at times is very common at Priest Rapids and along the lower creeks; June to September. Oviposits on globe mallow (*Iliamna rivularis*).

93. *Pholisora catullus* (F.). Commonest at low elevations, such as Priest Rapids and Cottonwood Creek, but also seen along other creeks up to 3500′; April to August. Larvae on common mallow (*Malva rotundifolia*) in Yakima.

94. *Erynnis propertius* (Scud. & Burg.) This large *Erynnis* is quite common along the creeks at 1000-3000′; but also taken at Satus Pass at 3500′; April to July.

95. *Erynnis icelus* (Scud. & Burg.) In the same locations as the last; May to July; also on Short and Dirty Ridge (7000′), July.

96. *Erynnis persius* (Scud.) Also in the same locations; April to July; and on the Cascade Crest Trail (5500′), July.

97. *Carterocephalus palaemon* (Pallas). A single specimen, Little Naches River (3000′), June 30.

98. *Hesperia juba* (Scud.) Quite common at lower elevations; Priest Rapids, along all creeks, and at Satus Pass; late April to July.

99. *Hesperia harpalus* (Edw.) Taken at lower elevations in September. The subspecies *oregonia* (Edw.) taken above 3000 in July.

100. *Ochlodes sylvanoides* (Bdv.) The commonest skipper; 500-6500′; July to September.

101. *Polites sabuleti* (Bdv.) Noted only in Yakima and some of the valley towns, on lawns. Mostly in September, but one taken in June and Dr. Good reports seeing it as early as May. Larvae on lawn grass.

102. *Euphyes vestris* (Bdv.). A single specimen, Bird Creek (3000′), June 26.

103. *Amblyscirtes vialis* (Edw.). This small, inconspicuous species has been noted only along Oak Creek and in Bear Canyon (3000′); June and early July.

The following 26 species have been taken in Washington in addition to those listed above. The starred (*) species could very well occur in Yakima County. **Colias philodice* Godart, **C. interior* Scud (Leighton, 1948, reports this from Yakima on the authority of J. F. Gates Clarke), *C. nastes* Bdv., **Oeneis chryxus* (Dbldy.) (taken at Satus Pass by Dan Carney), *O. melissa beanii Elwes, Erebia vidleri* Elwes,

E. disa Thunberg, *Boloria astarte* (*Dbldy*)., *B. toddi ammiralis* (Hemming), *Euphydryas anica* Dbldy.), *Phyciodes tharos* (Drury), **P. mylitta mata* (Reak.) (=*barnesi* Skinner), *Nymphalis j-album* (Bdv. & Lec.), *Polygonia gracilis* (G. & R.), *Limenitis bredowii californica* (Butler) *Callophrys nelsoni* (Bdv.), *C. johnsoni* (Skinner), **C. affinis* (Edw.), *Lycaena editha* (Mead), *Pyrgus centaureae freija* Warren, **Erynnis pacuvius lilius* (Dyar), *Hesperia comma manitoba* (Scud.), *H. comma hulbirti* Lindsey, *Polites mardon* (Edw.), *T. sonora* (Scud.), and *T. themistocles* (Latr.).

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BOOK NOTICE

LARVAE OF THE NORTH AMERICAN TORTRICINAE (Lepidoptera: Tortricidae). By Margaret Rae MacKay. Canadian Entomologist, Supplement 28, 182 pp., including 86 plates. Nov. 6, 1962. Paper and cloth.

This work is a continuation of that published by MacKay on the larvae of the Olethreutidae (now considered to be a subfamily of the Tortricidae) in 1959 (Canad. Ent., Suppl. 10). The present treatment includes descriptions of the late instar larvae of 97 species, or about 60% of the known North American species. As there has been no previous attempt to present keys to a significant portion of this fauna, the work fills a conspicuous void; since the group includes numerous species of economic importance, the identification aspect itself will be of great value. However, the real significance of the work lies in MacKay's interpretation of relationships of and within the Tortricinae, based on larval characters. It is particularly opportune that her work follows a decade of gross revision of the classification of the Tortricoidea, in both the Palearctic and Nearctic regions. MacKay's concepts correlate rather well with those of Obraztsov (1954, 1955 Tijd. voor Ent., etc.) and others, based on characters of the adults, and with Swatschek's (1958, Larvalsystematik der Insecten) study of the larvae of Palearctic species. In addition, the American group Sparganothidini is considered to be a Tribe for the first time, a concept confirmed by the work of Powell (1964, U. Calif. Publ. Ent.), based on comparative biology, which was in press concurrently. — EDITOR

BUTTERFLY MIGRATIONS IN SOUTHEASTERN MÉXICO DURING 1963 AND 1964

The rain season should normally begin in the northern portion of the peninsula of Yucatán in late May or early June. In 1963, normal rains did not begin until early August. During June and July, the prevailing dry, hot, southeast wind, which is characteristic of the dry season from January or February to May, persisted. Insects of all orders were greatly affected, especially the Lepidoptera.

About June 8, 9, and 10, however, torrencial rains fell in Campeche, Quintana Roo, and in the hilly Puuc region of southern Yucatán. Northern Yucatán experienced only slight drizzle. This precipition was caused by a temporary shifting of the wind from the southeast to east. The latter are the normal wet-season winds.

On June 11, there suddenly appeared in Mérida, Yucatán, a large migration of *Kricogonia castalia lyside* Godart. Individuals were flying in very large numbers, at about tree- and roof-top height and higher in the city, travelling from west-southwest to slightly north of east. This migration ceased at night, and continued through the morning of June 14. During the afternoon of that day, a rainstorm from the east occurred, after which the species in mind began flying from north to south, still in great numbers. On June 15, the migration's direction changed from west-southwest to slightly north of east, as in the beginning, however now in much lesser numbers. During the heaviest parts of the migration, approximately 1000 individuals passed per 100 feet of housetops per minute. On June 16, I had to leave the city on a four day trip to northern Quintana Roo and noticed that no *K. c. lyside* were migrating in central or eastern Yucatán nor in Quintana Roo itself, not even at a distance of 30 kilometers east of Mérida. On returing home on June 20, I only saw small numbers of the species flying, along with *Libytheana carinenta* Cramer on the outskirts of Mérida, going from west to east. During the afternoon of that day many were seen resting on dryish thorn trees. Apparently the migration had stopped.

On July 9, in Mérida, with the rains still lacking over most of Yucatán, *Eunica monima* Cramer, *Agraulis vanillae* Linn., and a few other odds and ends accompanied *K. c. lyside* in a much shorter migration from north-northwest to slightly south of southeast, with fair numbers of individuals involved, but certainly not as great as the aforementioned migration of the latter species. The winds at this time were still hot and dry from the southeast, more typical of the dry season than for the month of July.

Near San Antonio (now called Cárdenas), Tabasco, a migration of *Calpodes ethlius* (Stoll) (determined by Lee D. Miller, University of

Pittsburgh) was observed from three to four o'clock in the afternoon of March 8, 1964, in a large grassy swamp. The flight was heavy, calculated at about 500 individuals crossing per 100 feet of highway per minute. These expert fliers were wary and hard to catch, as in half an hour I managed to collect only five specimens, besides another I picked up that was hit by a car. At first they flew directly from north to south, but curiously and slowly changed from west to east, finally changing to southwest to northeast. This changing of direction on the vast, open, flat, swampy lowland in only an hour's time doesn't make much sense. It might be surmized that they were only flying circles within the particular swamp where I observed them. It might be mentioned that the southern end of the swamp was south of the road and very close to the same, and was rounded as if the road were a line cut through the middle of a circle, being surrounded by swamp forest. However north of the road the swamps extended as far as the eye could see. Perhaps these creatures, on reaching the southern end of the swamp and encountering the forest, circled back to stay within the limits of the more open grassy areas. The winds on that afternoon were mild and hot from the southeast.

Lee D. Miller calls my attention to an article published by C. B. Williams (Records of Insect Migration in Tropical America, 1920, *Trans. Ent. Soc.* LONDON, 68:154-159), in which excellent detail is given on migratory habits of *Calpodes ethlius* in Panama. In this article it will be noticed that this species in migration does not adhere to one single direction, mention being made of it "passing in almost every direction" in the course of a single afternoon and evening.

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HUMIDITY, DARKNESS, AND GOLD SPOTS AS POSSIBLE FACTORS IN PUPAL DURATION OF MONARCH BUTTERFLIES

by BRUCE PETERSEN

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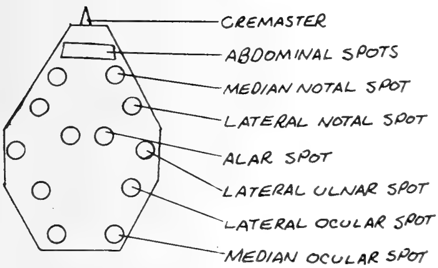
In his recent book on the monarch butterfly, *Danaus plexippus* (L.), Dr. F. A. Urquhart (1961: 38-39) encouraged work on the pupal stage with these statements: "I am of the opinion that these spots are not purely ornamental, but that they perform a definite function. They may act as light receptors that delay emergence of the adult butterfly during periods of adverse weather conditions.", and "Presumably some light perception mechanism controls the rate of development, allowing more rapid development on bright, sunny days, and virtually no development during periods of darkness." Accordingly, the following two experiments were conducted.

The effect of painting the gold spots of the monarch butterfly chrysalis on the emergence time of the adult was tested. Twenty-seven monarch butterfly chrysalids were put in nine groups of three each on the day after pupation. All of the gold spots on the chrysalids in group 1 were painted over with red fingernail polish. Groups 2 through 7 had various combinations of spots painted. Group 8 was daubed with polish, but care was taken not to cover any of the spots. Group 9 was not painted (figure 1).

One pupa in group 7 died. Butterflies emerged from the remaining chrysalids in eleven to fifteen days. The time prior to emergence seemed unaltered by the red fingernail polish. The butterflies emerged at varying intervals in all groups. Two possible conclusions come to mind: fingernail polish is not an effective means of keeping out light, or the gold spots on monarch butterfly chrysalids do not function as photoreceptors that effect the emergence period. The latter explanation seems more likely.

FIGURE I



DIAGRAMATIC REPRESENTATION OF SPOTS ON A MONARCH BUTTERFLY CHRYSALIS

● SPOT PAINTED

O SPOT LEFT UNPAINTED

THERE APPEARS TO BE AS MUCH VARIATION IN PUPAL TIME AMONG SIMILARLY PAINTED PUPAE AS THERE IS BETWEEN PAINTED PUPAE AND UNPAINTED ONES. THE SPOTS DO NOT APPEAR TO AFFECT EMERGENCE DATES.

GROUP	DAYS SPENT IN PUPA		
1	11	13	14
2	14	11	11
3	11	11	12
4	12	11	13
5	12	13	14
6	15	14	12
7	12	X	13
8	12	15	12
9	12	12	13

An experiment was performed to test effects of humidity and darkness on pupal maturation of monarch butterflies. Ten chrysalids were suspended by a thread tied to their cremasters from the lids of each of five transparent plastic containers on the day after pupation. The cylindrical containers were 10 cm deep, and 25 cm in diameter. One container of chrysalids was set aside as a control. The second container was placed 25 cm under a 60 watt desk lamp that shone continuously. The third was placed in a dark cupboard. Containers 4 and 5 were loosely lined with cheesecloth. Three cm of water was added to both. Container 4 was placed under the desk lamp, while 5 was put in the cupboard.

A graph showing the number of days required until emergence of the butterflies in each group is given (figure 2). The butterflies in the dry light container emerged, along with those of the control group, over a five day period, requiring less than thirteen days to mature. The butterflies in the light and humid container all emerged by the thirteenth day, also, but almost all came out on the thirteenth day. The emergence of the butterflies kept in the dark was delayed several days. The first ones did not complete their metamorphosis until the twelfth day. The ones in the humid dark chamber emerged about a day behind those in the dry dark container.

One can conclude that both humidity and darkness retard development of monarch pupae and that darkness is a more significant factor than humidity. A combination of total darkness and a saturated atmosphere cannot delay the monarch butterfly's emergence from his chrysalis more than about five days.

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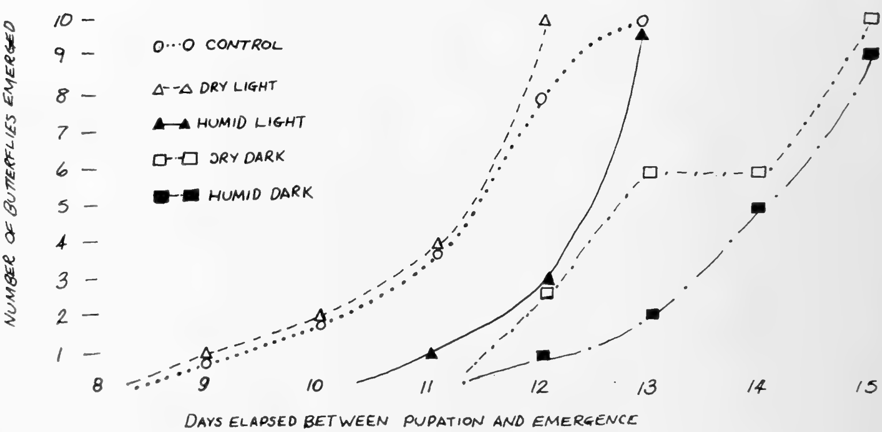
FIGURE 2



DISCOVERY AND OBSERVATIONS OF *BOLORIA EUNOMIA* (NYMPHALIDAE) IN MICHIGAN

By M. C. Nielsen

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Since reading Klots' Field Guide (1951), I have been intrigued with the possibility of finding *Boloria eunomia* (Esper) in Michigan, especially in one of the many sphagnum bogs of the Upper Peninsula. The recent discovery of *B. frigga* (Thunberg) in a large sphagnum-heath bog north of Manistique, Michigan, by S. T. Hubbell (1957) merely intensified my desire to search for the former species, a subarctic butterfly. Then on June 13-15, 1963, I collected a long series of *B. eunomia* in Mackinac and Chippewa Counties, the first record of this species for Michigan. It appeared from my series that the northern peninsula's population represented the subspecies *dawsoni* (Barnes and McDunnough). Some of the specimens, especially the males, exhibit considerable black dusting on the dorsal side of the forewing, and to some extent on the hindwing, in the medial and terminal areas (Plate 1). There is very little variation in the markings on the ventral side of the wings. The determination of *B. eunomia dawsoni* was subsequently confirmed by Dr. A. B. Klots upon his examination of representative specimens of both sexes.

A total of forty-five specimens of *B. eunomia dawsoni* was collected in two counties situated in the extreme eastern part of the Upper Peninsula, between the 46 and 47 parallels of latitude. The first collecting site was a sphagnum bog, about 60 acres in area, located a mile north of the Village of Cedarville in Township 42 North, Range 1 East, Section 19, SW¼, at an elevation of approximately 675 feet above sea level. On June 13 at 9:00 A.M. I stopped along Highway M-129 to investigate what looked like an interesting bog for diurnal lepidoptera. It was a sunny morning with a few clouds, and the temperature was near 65 degrees and rising; certainly suitable weather for most butterflies. After walking through the center and wettest part of the bog without seeing anything of great interest, I came to an area of scattered black spruce (*Picea marina*) and tamarack (*Larix laricina*) near the south perimeter of the bog. Suddenly, what appeared to be a small, dark *Boloria* was spotted flying very low and swiftly along a narrow zone of leatherleaf (*Chamaedaphne calyculata*). It was flying much faster and with a distinctive flickering flight than *B. selene atrocostalis* (Huard), which was expected to be here at this time. Within the next few minutes I collected the first *eunomia* for the state. I had no difficulty taking 25 additional specimens from 9:15 to 10:00 A.M., and others

were seen but not captured. Most of the butterflies were collected in two small openings, within the black spruce-tamarack area, in which a mixed cover of leatherleaf, bog rosemary (*Andromeda glaucophylla*), cranberry (*Vaccinium*) and sedges (*Carex*) formed a low growth above the wet sphagnum mat. It was easier to maneuver here and still net *eunomia* in numbers than elsewhere in the bog. Labrador tea (*Ledum groenlandicum,* in full bloom, was in abundance around the edges of these openings. Also, scattered in these openings were rose pogonia orchid (*Pogonia ophioglossoides*), sundew (*Drosera*), pitcher-plant (*Sarracenia purpurea*), cotton grass (*Eriophorum spissum*) and a few spruce and tamarack seedlings. *Boloria eunomia* did not appear to wander too far into the more open and wetter part of the bog where there was scattered clumps of shrubby cinquefoil (*Potentilla fruticosa*) and arbor vitae (*Thuja occidentalis*). Actually, the butterflies spent considerable time flying back and forth close to vegetation in these openings before moving, to new areas in the spruce-tamarack. Occasionally, a few would settle on the vegetation to catch the morning sun and dry their wings which were still somewhat limp from recent emergence; one individual was observed feeding on Labrador tea flowers.

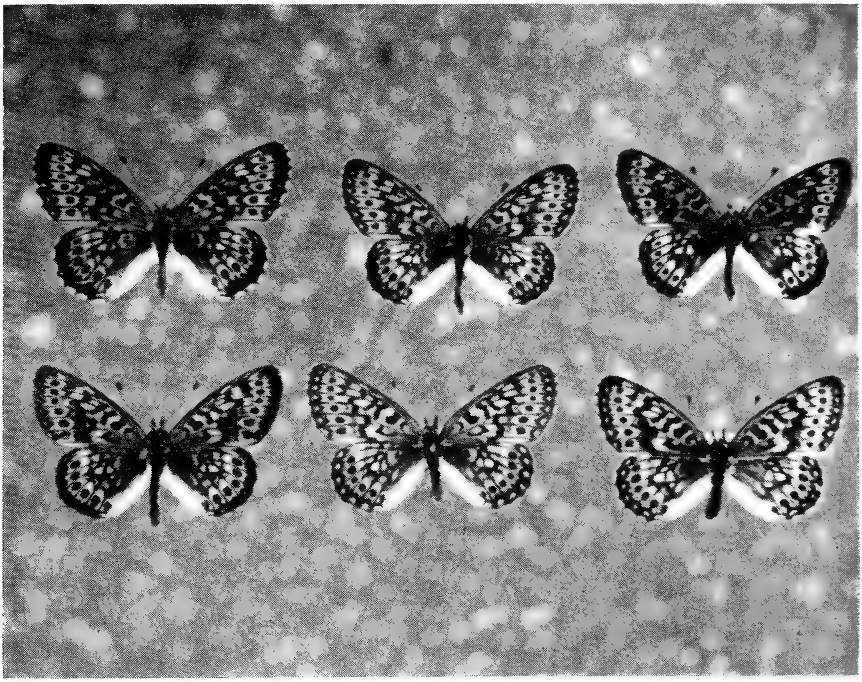
Males outnumbered females by five to one judging from specimens taken and observed at this location during my two rather brief visits on June 13 and 14. Most male specimens were in fresh condition, although some were slightly worn, suggesting at least a few days of prior flight. All females were perfect and were probably still emerging as indicated by their immaculate condition and relative scarcity. On June 14, another brief encounter was made with *eunomia* from 2:00 to 4:00 P.M. in this bog. The weather and results were comparable to that of the previous day, except that I was more selective in my collecting and released all worn males.

Several times I observed *B. eunomia* males aggressively flying at each other and performing aerial maneuvers – sometimes rising above the tallest spruce trees before disengaging and returning to normal flight. In one instance, a male successfully drove off a huge *Danaus plexippus* (L.) which happened to glide into one of these openings or "*eunomia*" territory. I have never observed this pugnacious character before with our other Michigan *Boloria* species.

Klots in Ehrlich's (1961) recent book states that violet and polygonum are foodplants for *B. eunomia* in Europe. These plants were not found in or near the openings described above, which would indicate that perhaps one of the heaths is the preferred foodplant here. I felt as if I was in the center of *eunomia's* habitat judging from its relative abundance in this bog.

A few *Boloria selene atrocostalis* (Huard) (fresh) were flying in company with *eunomia*. Twice *Oeneis jutta* (Huebner) was flushed from black spruce — thus establishing a new county record for this species. *Callophrys augustinus* (Westwood) (badly worn) was also taken here, and occasionally *Papilio glaucus* L. sailed through the spruce. A fresh *Poanes hobomok* (Harris) was netted while feeding on a rose pogonia orchid in one of the openings where *eunomia* was plentiful.

On June 15 in Chippewa County, about seven miles northwest of the community of Paradise, I netted eight additional specimens of *B. eunomia dawsoni* in a large acid bog. The locality is in Township 49 North, Range 7 West, Sections 9, 10, 15, 16. This particular bog had long been on my list of potentially choice habitats for boreal species, and it was my first opportunity to collect here at this time of year. In viewing aerial photographs and the U. S. Department of Interior "Sheephead Lake Quadrangle", this bog covers some 10,000 acres easterly of Sheephead Lake



EXPLANATION OF PLATE

Boloria eunomia dawsoni (B. & McD.), dorsal views; collected in Mackinac County, Michigan, June 13-14, 1963. Upper row: males (left to right, 39,37, 37 mm). Bottom row: Left, male (38 mm); middle and right, females (38, 38 mm). (All specimens in writer's collection).

and is situated approximately 700 feet above sea level. I felt very fortunate to establish this new butterfly record in another county within such a short time. The species was relatively scarce in the area sampled which centered around a pine-covered, sand ridge extending across the bog and providing easy access by way of a trail road. This new location is about 60 miles northwest from the aforementioned Mackinac County bog. The flora is similar to that encountered in the Mackinac bog, although it contains no arbor vitae or cinquefoil – at least in the area I collected. According to the Soil Survey of Chippewa County (Veatch, 1927), the soil in this bog is classified as Greenwood Peat, characterized by such plants as leatherleaf, Labrador tea, blueberry, cranberry and sphagnum moss. In some places stunted and open growth tamarack and black spruce occupies the bog, while in a large portion there is a dense stand of sedges. Once again I did not observe *eunomia* ovipositing or find violets or polygonum plants. I doubt if my collecting here was in the area of highest population density such as in the Mackinac bog.

Both sexes of *O. jutta* (a new Chippewa County record) were considerably more numerous here among the black spruce, and I observed some resting on Labrador tea flowers and cotton grass tufts. Frequently my attention was diverted from pursuing *eunomia* when *jutta* would take flight from spruce or sedges. A high water table, which formed small pools and gave the sphagnum more springiness, made collecting considerably more difficult in this bog. Two species of diurnal Noctuidae, *Anarta cordigera* Thunberg (worn) and *Autographa microgamma* Huebner (fresh) were flying and feeding on the blossoms of Labrador tea and swamp laurel (*Kalmia polifolia*) in the same area as *eunomia*. From 11:30 A.M. to 2:00 P.M., I observed approximately a dozen *B. eunomia dawsoni* in this huge bog; nevertheless it was a beautiful day with temperatures in the 80's, ideal weather for bog lepidoptera.

According to Macy and Shepard (1941), the type series of *Boloria eunomia dawsoni* was collected from June 15 to June 30 at Hymers, Ontario, Canada, which is some 240 miles northwest of the above Chippewa bog. Riotte (1959) records this subspecies from several locations in northern Ontario, with its flight peaking toward the end of June. His correspondence has indicated a habitat for *eunomia* comparable to what I found in the Chippewa and Mackinac bogs. Klots (1939) reports *Boloria aphirape* (Huebner) (*eunomia*) from the Klondike Basin in Maine occupying a somewhat similar habitat as the sphagnum-heath bogs described herein – except for the difference in elevation. He, too, did not find violets (or polygonum) where this species was collected.

In summary, judging from my brief experience with *B. eunomia dawsoni,* it would appear that this subspecies flies in the eastern Upper Peninsula during June, probably peaking around June 15. Moore (1960) did not record this butterfly from Michigan; however, it is doubtful if *eunomia* can be considered a recent arrival to our bog fauna – most likely the species was overlooked by previous collectors. In the future, I hope to spend more time in these two bogs in an attempt to discover the foodplant and more of its habits. It is my belief that *B. eunomia dawsoni* will eventually be discovered in other bogs across the Upper Peninsula, and that collectors in northern Wisconsin and Minnesota should definitely search for it in similar bogs in June. These northern bogs will undoubtedly yield other interesting lepidoptera with further diligent collecting. Possibly more of the boreal species such as *Boloria freija* (Thunberg) and *titania grandis* (B. & McD.) (May and July-August, respectively) can be collected in these and other bogs!

Acknowledgements

I wish to express my sincere appreciation to Dr. Alexander B. Klots for his examination and verification of my *Boloria* specimens. Also, I am greatly indebted to Julian P. Donahue for the excellent photograph.

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ARTHUR FRANCIS HEMMING (1893-1964)

Arthur Francis Hemming was born on Feburuary 9th, 1893. It was his mother, herself a discerning collector in other fields, who fostered and encouraged his early interest in butterflies; and it was with her that he made his first journeys abroad in pursuit of them. Educated at Rugby and Corpus Christi College, Oxford, like most young men of spirit he joined the forces on the outbreak of war and was commissioned in the Duke

of Wellington's Regiment in August, 1914. Severely wounded in 1916, he was invalided out in 1918, and straightway found himself appointed to the Treasury and to a long succession of senior civil service posts. Entomologically, the most important of these was his Secretaryship of the Economic Advisory Council (1930-1939), since it enabled him to give official support to a number of projects the importance of which might otherwise have been missed, such as, for example, the provision of better accommodation for the Entomological Department of the British Museum (Natural History) and the launching of the Anti-Locust Research Centre. From 1929 to 1939 he was Treasurer of the Royal Entomological Society of London, in 1932 he joined the editorial panel of *The Entomologist,* and in 1936 accepted the honorary and onerous post of Secretary to the International Commission on Zoological Nomenclature. There is no doubt that the Entomological Society owes much of its subsequent success to the sound basis of development laid down by Hemming during his tenure of office. His work for the Nomenclature Commission earned wide international recognition. Not only did he, through the Bulletin of Zoological Nomenclature, bring the whole subject before the zoological world in free and open discussion and by the publication of the Commission's decisions on matters in dispute, but, over the years he undoubtedly built up by modification and extension of the old Règles the substance of the new Code which was adopted by the Zoological Congress in London in 1958. It was a bitter disappointment to him that ill health prevented him from sharing in the culminating event.

The earliest of Francis Hemming's contributions to entomological literature concerned a rare white form of the male of the high altitude *Colias euxanthe* of Peru (*Proc. ent. Soc. London* 1925:iv). Thereafter, except when in pursuit of some nomenclatural or bibliographical puzzle, his writings were confirmed to the butterflies of the Palaearctic Region. By 1926 he had already built up extensive fully documented records of the distribution of the butterflies of France, and two papers based on these data, on *Araschnia levana* and *Agriades thersites,* were published in *The Entomologist* (1926 and 1928). About this time he began also to publish short revisional papers, principally on Palaearctic Lycaenidae, resulting from the rearrangement of this family in the British Museum (Natural History) which he had been persuaded to undertake. Genera and species dealt with included *Turanana, Iolana, Lycaena virgaureae, Lycaenopsis, Baoris zelleri, Scolitantides,* Syrian and Japanese Lycaenidae. A longer paper (1932, *Tr. ent. Soc. London* 80: 269-299) was devoted to a study of the butterflies of Transjordan.

These studies inevitably brought to light the extraordinary lack of precision prevalent in the nomenclature of the Rhopalocera, in which group little attempt had yet been made to apply the rules of nomenclature

currently available. Application of the rules was aslo hindered and greatly complicated by the lack of precise information on the dates of publication of most of the early works of basic importance. A series of shorter papers of a preliminary nature on these subjects led to the publication of the *Generic names of the Holarctic Butterflies*, 1758-1863, by the Trustees of the British Museum in 1934, in which Hemming attempted to fix the type species of all the generic names proposed, in accordance with the International Rules of Zoological Nomenclature. This has proved an invaluable work of reference. The manuscript of what was to be the complementary volume, covering 1863 to 1963, but which in the end covered the generic names of the Rhopalocera of the world from 1758 to 1963, was completed by Hemming only a few weeks before he died. In the purely bibliographical field Hemming's outstanding contribution was his collation of Jacob Hübner's published works and his manuscripts, issued in 1937 in two volumes, and establishing, finally one hopes, the dates of the new generic names of Lepidoptera, numbering upwards of 1500, proposed by Hübner and his successor, Geyer.

It was the privilege of the author of this brief notice to have enjoyed Hemming's close friendship for upwards of forty years, and during those years to have learnt much from him and perhaps at times to have helped him a little. The sudden death of this remarkable man on 22nd February, 1964, when all his painstaking labours on the bibliography, nomenclature and classification of the Rhopalocera were so nearly complete is much more than a personal loss. It is believed that his manuscripts may find a home in the British Museum (Natural History). His collection and his very fine library might, he hoped, be acceptable to some appropriate North American institute where their usefulness would probably prove greater than in Europe. The list of his published writings, including those on nomenclature, runs to over one thousand titles.

N. D. Riley, British Museum (Natural History), London, ENGLAND.

CHARLES J. VOGT (1885-1964)

On March 16, 1964, Charles J. Vogt of Eden Valley, Minnesota, died after four days of unconciousness brought on by a stroke. Charlie, as he was called by everyone who was priviliged to know him, was 78 years old.

Although Mr. Vogt was a newcomer to the field of Lepidoptera, he apparently had a close bond with nature since earlier days. He had spent a good part of his time working in the United States Forestry Service, from which he was retired, and loved the outdoors immensely. He was an extremely enthusiastic gardener and took care of several acres of land in woody northern Minnesota alone in the latler years of

his life. He also had worked in construction business and was an excellent carpenter.

During his retired years, he spent many hours growing flowers for invalids at Camp Courage, an Easter Seal Camp for Crippled Children at Maple Lake, Minnesota, where he also donated numerous display cases of mounted butterflies, moths, and other insects for the entertainment of less fortunate people than he. This latter activity was an indication of the generous, amiable character which Charlie had.

Charlie was a very active man, working at least 16 hours a day right up to the very end. He made a trip to Yucatán in early 1962, and another by car through eastern México into Yucatán in early 1963. His active and alert mind even at 78 years of age was a wonder to all; and he was deeply liked by all he knew here, where we adopted him as our "grandpa". He loved México and enjoyed everything in his trips, as much as might be expected of a young, curious lad; and it would not be untrue to say even more so.

Charlie joined the Lepidopterists Society in 1960, and I had maintained correspondence with him since 1958. His private collection of insects has been donated to the new Camp Courage Museum.

He was married, but his wife died long ago. His only offspring, a daughter, died at the age of 12 of a crippling disease, and it can be surmized that this event made him even more devoted in his desire to help crippled children. He is survived by two adopted children and several brothers and sisters, most of whom live in Wisconsin, all of whom receive our deepest sympathy.

EDUARDO C. WELLING M. Mérida, Yucatán, MEXICO

BOOK NOTICE

THE SKIPPERS OF THE GENUS *HESPERIA* IN WESTERN NORTH AMERICA, with special reference to California (Lepidoptera: Hesperiidae). By C. Don MacNeill. U. Calif. Publ. Ent., vol. 35, 230 pp. including 28 compound figs., 1 color and 7 half tone plates, 9 maps. April 7, 1964. Paper, $5.00.

The most detailed treatment of any group of North American butterflies is the result of more than a decade of meticulous work. Descriptions and evaluation of external morphological details of both sexes and of immature stages are presented for 12 of 19 recognized Nearctic species of the genus. The remaining seven species, which fall outside the geographical scope of the paper, are treated in the keys but not described. Geographical distributions are mapped and comparative illustrations of both male and female genitalic structures are provided for all North American species. Biological generalizations are offered concerning both adults and larvae, particularly concerning their behavior. Detailed distributional analyses, both geographic and biotic are presented for the eight species found in California.

Three subspecies are described as new: *H. uncas macswaini* (eastern Calif.), *H. uncas gilberti* (D. F., Mex.), and *H. pahaska martini* (Mts. of Mohave desert). These, together with *H. miriamae* MacNeill, 1959, are figured in color. Nine additional geographical segregates are distinguished for the first time but not named. —EDITOR

BOOK REVIEW

OUR BUTTERFLIES AND MOTHS. By William H. Howe. True Color Publishing Co., North Kansas City, Mo. 208 pp, including 25 colored plates and 70 black and white text figs. Cloth, $15.00.

In the preface, Mr. Howe, who is a widely known artist and amateur lepidopterist, gives a two-fold purpose for this book: a hope of stimulating interest in butterflies and moths among young people and to enable a better use of his water color paintings for the public. To these ends the book should prove successful.

Certainly many of the figures are good; the paintings are undoubtedly the best in accuracy of both color and structural detail to have been published for some of the species. A few have somewhat exaggerated brightness, but most are truly excellent. Some 125 species of butterflies and larger moths are shown in the 25 colored plates in addition to the many black and white drawings of other species, caterpillars, chrysalids, butterfly traps, etc. Species from various parts of the world are included; thus no geographical fauna is treated fully and there is not marked tendency towards illustration of the Kansas species in particular (as there is in the text). About 44 species of North American butterflies and 27 species of North American moths are pictured in color; the remainder are South American and Old World representatives, primarily butterflies.

Curiously, the four plates depicting Nearctic Heterocera are numbered 22 through 25 but occur in the book between plates 13 and 14. It appears that both *Hemileuca* (*Pseudohazis*) *hera* (Harris) (pl. 23) and *H. eglanterina* (Bdv.) (pl. 7) are figured under the species name *eglanterina*. In nearly every case the moths and butterflies are shown in study specimen, spread condition, although they are depicted in various arrangements superimposed on floral or scenic backgrounds in an attempt to make them appear more life-like. The combination is bothersome.

As understated in the publisher's letter accompanying advertisments for the book, "This is no complicated scientific monograph". The highly simplified text is written in a wordy, anecdotal, and at times flowery manner, often including repetitive phraseology. Nonetheless, it should be understandable and informative as well as stimulating to the layman. Several sections take the reader on armchair field trips or give accounts of Howe's experiences in widely scattered parts of the country. Narrated in a conversational fashion, these should quicken the pulse of confirmed collectors and entertain anyone interested in natural history; they include imaginary or idealistic expeditions to Florida, New Mexico, Colorado, and Mexico for butterflies, an evening collecting sphinx

moths, and still another copy of Holland's "Sugaring for Moths", revised to accomodate local species. Other reports of the author's personal experiences mainly concern Kansas localities and often include mention of his acquaintances.

Separate chapters treat the families of butterflies, sphinx moths, and silkmoths. These are not comparable in scope, varying from short natural histories of several representative species (Papilionidae) to collection methods (Lycaenidae) or Howe's memorable recollections of individual species (Satyridae). The chapter on silkmoths includes an historical sketch of *Bombyx* and gives almost no information on Saturniidae. Interspersed are numerous and varied fragments of entomological folklore, poems, and historical episodes, many of which are interesting or amusing but which do not add materially to the study of Lepidoptera.

Experienced Lepidopterists will for the most be little informed by the folksy, first person text which includes an annoying number of out-of-date generic combinations (*e.g., Megathymus neumoegeni, Hyloicus* for *perelegans* and other *Sphinx, Telea polyphemus, Samia* for *rubra* and other *Hyalophora*) and misspelled names (e.g., Abdomin, p. 25; *Celerio linneata,* pp. 88, 141; *Colias alexandria,* p. 66; *Hyloicus cheris,* p. 141). In addition, there is varying recognition of subspecific names. For example, both *Celastrina argiolus* and *C. pseudargiolus* are mentioned; either the subspecific or the specific name is omitted in some cases, while in others the geographical meaning of the subspecies is ignored or misinterpreted (e.g., "*Phoebis sennae eubule* is widely distributed . . . even on the West Coast", p. 65). Entomologists should be alarmed if not horrified by some of the oversimplified or erronous generalizations: "*Colias eurytheme* . . . never becomes so common as to be a serious pest to an alfalfa grower." (p. 64); The Monarch does not have "to worry about the attack of birds or other animals; . . . thanks to its acrid odor." (p. 72); *Glaucopsyche xerces* "was first reported to have vanished in 1908, an event that was likely hastened by the San Francisco fire." (p. 120); "Professional lepidopterists are too busy in museums with assigned duties to ever get outside and actually catch butterflies!" (p. 133)!

However, persons of all ages who are interested in natural history will find many fascinating and enlightening passages in the book. Sections such as the Colorado butterfly collecting guide should be of value to young beginning collectors and veterans alike. The color figures themselves will make the book usable for almost anyone interested in butterflies and moths.

Jerry A. Powell, University of California, Berkeley.

RECENT LITERATURE ON LEPIDOPTERA

Under this heading are included abstracts of papers and books of interest to lepidopterists. The world's literature is searched systematically, and it is intended that every work on Lepidoptera published after 1946 will be noticed here. Papers of only local interest and papers from this *Journal* are listed without abstract. Readers, not in North America, interested in assisting with this very large task, are invited to write Dr. P. F. Bellinger (Dept. of Natural Sciences, San Fernando Valley State College, Northridge, Calif., U. S. A.). Abstractors' initials are as follows:

[P.B.] – P. F. Bellinger	[W.H.] – W. Hackman	[N.O.] – N. S. Obraztsov
[I.C.] – I. F. B. Common	[T.I.] – Taro Iwase	[C.R.] – C. L. Remington
[W.C.] – W. C. Cook	[J.M.] – J. Moucha	[J.T.] – J. W. Tilden
[A.D.] – A. Diakonoff	[E.M.] – E. G. Munroe	[P.V.] – P. E. L. Viette

A. GENERAL

Collins, Michael M., & Robert D. Weast, *Wild Silk Moths of the United States, Saturniinae, experimental studies and observations of natural living habits and relationship.* 138 pp., illus. Cedar Rapids, Iowa: Collins Radio C. 1960. See review in *Journal,* vol.16: p.58.

Ehrlich, Paul R., "Lepidoptera." In *McGraw-Hill Encyclopedia of Science and Technology,* vol.7: pp.459-473, 11 figs. 1960.

Forbes, William T. M., J. G. Franclemont, & C. B. Knowlton, "The Lepidoptera of New York and neighboring states. Part IV." *Mem. Cornell Univ. agric. exper. Sta.* 371: 188 pp., 188 figs. 1960. See review in *Journal,* vol.17: pp.40-42. 1963.

Gullander, Bertil, *Nordens dagfjärilar* [in Swedish]. 93 pp., ill. Stockholm 1959. Popular handbook of all Scandinavian butterflies and skippers, with short remarks on all spp., and color drawings. [T. W. L.]

Gullander, Bertil, *Dagsommerfugle i Norden* [in Danish]. Copenhagen 1960. A Danish translation of *Nordens Dagfjärilar.* [T.W.L.]

Kettlewell, H. B. D., "Lepidoptera as scientific tools." *Journ. Lepid. Soc.,* vol.13: pp.173-177. 1963.

Langer, T. W., *Sjove ting om sommerfugle* [in Danish]). 182 pp., ill. Copenhagen 1960. A shorter and cheaper edition with the same color plates as *Nordens dagsommerfugle,* reviewed in *Lep. News.* vol.12: p.205. [T.W.L.]

Langer, T. W., *Allhems fjärilbok* [in Swedish]. Malmö 1958. A Swedish translation of *Sjove ting om sommerfugle.* [T.W.L.]

Langer, T. W.. *Danmarks dagsommerfugle* [in Danish]. 112 pp., ill. Copenhagen 1960. Systematic handbook of the Danish butterflies and skippers. [T.W.L.]

Langer, T. W., *Päiväperhosten parissa* [in Finnish]. Helsinki 1961. A Finnish translation of *Sjove ting om sommerfugle.* [T.W.L.]

Langer, T. W., *Sommerfugleliv. Strejftog i sommerfuglenes verden* [in Danish]. 126 pp., ill. Copenhagen 1963. Butterfly senses, catching, immigration, subspecies, colors, chemical control, genetics, variation, etc., illustrated by the major groups of European butterflies. [T.W.L.]

Morrell, R., *Common Malayan butterflies.* xii + 64 pp., 20 col. pls., 6 figs. London: Longmans Green, 1960. Figures some 110 spp. in color, with brief notes on these & related spp.; summaries structure of butterflies and of Malayan families; gives simple directions for collecting and care of specimens. An excellent introductory handbook. [P.B.]

Moucha, Josef, *Motýli.* 143 pp., 36 col. pls. Prague: Státní Dětské Knihy. 1962. See review in *Journal,* vol.16: p.150.

Niculescu, E. V., "Sur les caractères primitifs et spécialisés chez les lépidoptères" [in French]. *Bull. mens. Soc. linn. Lyon,* vol.32: pp.22-28. 1963. Discussion about

the meaning of the terms: "primitive characters" and "specialized characters" in the Lepidoptera. [P.V.]

Patočka, Ján, *Die Tannenschmetterlinge der Slowakei*. 219 pp., 470 figs. Bratislava: Slovak Academy of Sciences. 1960. See review in *Journal*, vol.15: p.74.

Ponec, Jozef, *Naše Motýle*. 99 pp., 205 figs. Bratislava: Osveta. 1960.

Shirozu, Takashi, *Butterflies of Formosa in colour* [in Japanese]. [8] + 482 + [2] pp., 76 pls., 479 figs. Osaka: Hoikusha. 1960. See review in *Journal*, vol.14: p.243.

B. SYSTEMATICS

Aagesen, Stig, "Nogle bemaerkinger til belysning af typeformen hos *Heodes phlaeas*" [in Danish]. *Flora og Fauna*, vol.59: pp.55-57, 2 figs. 1953. Proves that Linnaeus' type specimen had blue spots on upperside of hind wing. [T.W.L.]

Agarwala, S. B. D., & Mohammad Wasiul Haque, "Studies on *Argyria sticticraspis* Dudgeon – the early shoot borer of sugarcane in Bihar." *Indian Journ. Ent.*, vol.17: pp.307-314. 1955. Syn.: *Chilotraea infuscatellus*. Incidence, hosts, biology, life history. [J.D.]

Amsel, H. G., "Microlepidopteren aus dem Kaukasus und der Ukraine" [in German]. *Acta ent. Mus. nation. Pragae*, vol.33: pp.419-422, 2 figs. 1959. Records 39 spp. collected by J. Moucha in W. and central Caucasus. Describes as new *Lozopera caucasica* (Tbilisi – Chanisi), Tortricidae. [J.M.]

Amsel, H. G., "Eine neue japanische *Laspeyresia*-Art (Lepidoptera: Tortricidae)" [in German]. *Mushi*, vol.33: pp.105-106, 2 figs. 1960. Describes as new *L. kurokoi* (Kyushu, Hikosan, Buzen). [P.B.]

Aubert, Jacques F., "Supplément au travail concernant les géométrides palearctiques du genre *Entephria* Hb." [in French; German summary]. *Zeitschr. wiener ent. Ges.*, vol.45: pp.172-174, 1 pl. 1960. Describes as new *E. ignorata persicata* (Elburs, Tacht i Suleiman, Särdab valley (Vandarban), N. Persia) also names a "form". [P.B.]

Balduf, W. V., "A significant synonym of *Celerio intermedia* Kirby (Lepidoptera: Sphingidae)." *Ann. ent. Soc. Amer.*, vol.55: p.259. 1962. *C. oxybaphi*, referring to foodplant *Mirabilis* (=*Oxybaphus*), suggests early eastern invasion of this western plant, & physiological similarity of *C. intermedia* & *C. lineata*. [P.B.]

Balogh, Imre, "A new Hungarian moth (Oecophoridae)" [in English; Hungarian summary]. *Folia ent. hung.*, vol.4: pp.25-28, 3 figs. 1951. Describes as new *Martyrhilda gozmanyi* (Rupp Hill, Budapest, & Kaposvár, N. Hungary). [J.M.]

Balogh, Imre, "Eine neue Lycaenide aus Ungarn" [in Hungarian; German summary]. *Folia ent. hung.*, s.nn, vol.9: pp.65-77. 1956. Describes as new *Aricia allous issekutti* (Bálvány Mt., Bükk Mts., N. Hungary). [J.M.]

Bauer, David L., "Descriptions of two new *Chlosyne* (Nymphalidae) from Mexico, with a discussion of related forms." *Journ. Lepid. Soc.*, vol.14: pp.148-154, 1 pl., 2 figs. 1961. Describes as new *C. rosita browni* (El Salto. 1600 ft., San Luis Potosi), *C. riobalsensis* (Mexcala, 2000 ft., Guerrero).

Bell, Ernest L., "Descriptions of some new species of neotropical Hesperiidae (Lepidoptera, Rhopalocera)." *Amer. Mus. Novit.*, no.1962: 16 pp., 27 figs. 1959. Describes as new *Dalla pota* (R. Mapoto, Ecuador), *D. cola* (R. San Joaquin, Cauca, Colombia); *Corticea graziellae* (Joao Pessoa, Paraiba, Brazil); *Zalomes dores* (Carmen, Ecuador); *Moeris patriciae* (Salama, Guatemala, 3000 ft.); *Cobalopsis brema* (New Bremen, Santa Catharina, Brazil); *Psoralis alis* (Massaranduba, Blumenau, Santa Catharina, Brazil); *Argon casca* (Cascade Mt. Road, St. Anne, Trinidad, W.I.); *Phlebodes pares* (Mubevo, Paraguay); *Oarisma bruneri* (Moa, Cuba); *Paratrytone browni* (Cerro El Muerto, Talamanca, Costa Rica, 11,500 ft.); *Mellana agnesae* (Acapulco, Guerrero, Mexico); *Vaccera molla* (Molleturo, Ecuador, 7700 ft.). [P.B.]

Bender, R., "Beiträge zur Lepidopterenfauna der Insel Rhodos" [in German]. *Zeitschr. wiener ent. Ges.*, vol.48: pp.11-20, 2 pls. 1963. Review of previous studies & annotated list of 150 macros from Rhodes. Figures races of *Gonepteryx cleopatra* (in color), *Maniola telmessia ornata*, & *Glaucopsyche alexis insulicola*. [P.B.]

Bentinck, G. A., "*Coleophora lutipenella* Z. en *C. flavipenella* H.-S." [in Dutch; English summary]. *Ent. Berichten,* vol.20: pp.75-76. 1960. Notes on nomenclature, & on occurrence in Holland. [P.B.]

Bernardi, G., "Le polymorphisme de deux espèces jumelles du genre *Dixeia* Talbot" [in French]. *Bull. Inst. franç. Afr. noire* (A), vol.23: pp.496-505, 4 figs. 1961. Note on the polymorphism of two sibling species of West African pierids: *D. capricornus* & *D. cebron.* [P.V.]

Bernardi, G., "Note sur deux espèces jumelles du genre *Aporia* Hübner (Lep. Pieridae)" [in French]. *Bull. Soc. ent. France.* vol.65: pp.221-228, 17 figs., 1 pl. "1960" [1961]. Note on the sibling species *A. hippia* & *A. bieti* and their subspecies. [P.V.]

Bernardi, G., & P. Viette, "Que representent *Zygaena pennina* Rambur (1866), *Z. eudaemon* Mabille et *Z. mauritanica* Mabille (1885)? (Lep. Zygaenidae)" [in French]. *Bull. mens. Soc. linn. Lyon,* vol.30: pp.140-145. 1961.Notes on the identity of three spp. of *Zygaena* named by Rambur and Mabille. *Z. pennina* is a species close to *Z. contaminei;* new collections of *Z. pennina* are needed to give a sure conclusion about this species. *Z. eudaemon* is a synonym of *Z. felix;* this last species was decribed from East, not West, Algeria (error by Staudinger). *Z. mauretanica* is badly labelled "Algeria" and is a synonym of *Z. fausta genevensis,* as is *Z. f. mabillei.* The lectotype of *Z. mauretanica* is a ♀ (and not a ♂ as indicated by a misprint). [P.V.]

Bernardi, G., & P. Viette, "Une nouvelle sous-espèce de *Parnassius mnemosyne* (L.) (Lepidoptera Papilionidae)" [in French]. *Rev. franç. Ent.,* vol.28: pp.54-56, 2 figs. 1961. Description of *P. m. vivaricus,* a new subspecies from central France. [P.V.]

Bernardi, G., "Note sur la position systématique correcte du *Lycaena pontica* Courvoisier (Lep. Lycaenidae)" [in French]. *Rev. franc. Ent.,* vol.29: pp.238-240, 1 fig. 1962. *L. pontica* is, in fact, a subspecies of *Lysandra coelestina.* [P.V.]

Bernardi, G., "Un nouveau cas d'espèces jumelles chez les *Aporia* Hübner (Lep. Pieridae)" [in French]. *Bull. Soc. ent. France,* vol.67: pp.173-181, 13 figs. 1963. Study of the sibling species *A. potanini* & *A. genestieri.* Describes as new *A. g. pseudopotanini* (Tsing-ling-schan Mts., Tai-pai-chan) and *A. g. genestieroides* (Thibet, Gad-ssu-Be-ta). [P.V.]

Biezanko, C. M., "Danaidae et Ithomiidae da zona sueste do Rio Grande do Sul" [in Portuguese]. *Arq. Ent.,* Pelotas,série A, III: 6 pp., 1 fig. 1960. List of 14 spp., with systmatic and biological notes. [P.B.]

Biezanko, C. M., "Danaidae et Ithomiidae da zona missioneira do Rio Grande do Sul" [in Portuguese]. *Arq. Ent.,* Pelotas, Série B, III: 6 pp., 1 fig. 1960. Records of 21 spp., with systematic & biological notes. [P.B.]

Biezanko, C. M., "Satyridae, Morphidae et Brassolidae da zona missioneira do Rio Grande do Sul" [in Portuguese]. *Arq. Ent.,* Pelotas, série B, IV: 10 pp., 1 fig. 1960. List of 45 spp., with systematic & biological notes. [P.B.]

Biezanko, C. M., "Satyridae, Morphidae et Brassolidae da zona sueste do Rio Grande do Sul" [in Portuguese]. *Arq. Ent.,* Pelotas, série A, IV: 12 pp., 2 figs. 1960. List of 28 spp., with systematic & biologigcal notes. [P.B.]

Biezanko, C. M., "Castniidae, Zygaenidae, Dalceridae, Eucleidae, Megalopygidae, Cossidae et Hepialidae da zona missioneira do Rio Grande do Sul" [in Portuguese]. *Arq. Ent.,* Pelotas, série B., XIV: 8 pp., 1 fig. 1961. Annotated list of 63 spp., with some systematic notes by W. T. M. Forbes. [P.B.]

Biezanko, C. M., "Castniidae, Zygaenidae, Dalceridae, Eucleidae, Megalopygidae, Cossidae et Hepialidae da zona sueste do Rio Grando do Sul" [in Portuguese]. *Arq. Ent.,* Pelotas, série A, XIV: 8 pp., 2 figs. 1961. Annotated list of 58 spp., with some systematic notes by Forbes. [P.B.]

Biezanko, C. M., "Olethreutidae, Tortricidae, Phaloniidae, Aegeriidae, Glyphipterigidae, Yponomeutidae, Gelechiidae, Oecophoridae, Xylorictidae, Lithocolletidae, Cecidoseidae, Ridiaschinidae, Acrolophidae, Tineidae et Psychidae da zona sueste do Rio Grande do Sul" [in Portuguese]. *Arq. Ent.,* Pelotas, série

A., XIII: 16 pp., 1 fig. 1961. Preliminary list of some 75 spp., with systematic notes by Forbes & others. Many foodplants recorded. [P.B.]

Biezanko, C. M., "Olethreutidae, Tortricidae, Yponomeutidae, Gelechiidae, Oecophoridae, Xylorictidae, Cecidoseidae, Acrolophidae, Tineidae, Psychidae et Arrhenophanidae da zona missioneira do Rio Grande do Sul" [in Portuguese]. *Arq. Ent.*, Pelotas, serie B, XIII: 8 pp., 1 fig. 1961. Preliminary list of 28 spp. with some systematic notes. Many foodplants recorded. [P.B.]

Biezanko, C. M., "Notodontidae et Dioptidae da zona sueste do Rio Grande do Sul" [in Portuguese]. *Arq. Ent.*, Pelotas, serie A, VIIIA: 14 pp., 3 figs. 1962. Annotated list of some 80 Notodontidae & 5 Dioptidae, with some systematic notes by Forbes. [P.B.]

Biezanko, C. M., & A. Ruffinelli, "Nota sobre la invalidez de los generos *Angitia* y *Tortricodes* (Lep. Noctuidae)" [in Spanish]. *Rev. Soc. uruguaya Ent.*, vol.5: pp.45-46. 1963. Proposes *BLANCHARDITIA* to replace *Angitia* (preoccupied in Hymenoptera), & *ALBERTICODES* to replace *Tortricodes* Guenee, 1854 (preoccupied in Tortricidae). [P.B.]

Bigot, L., "Les *Stenoptilia* de la faune française (Lep. Pterophoridae)" [in French]. *Alexanor,* vol.2: pp.97-105, 2 pls. 1961. Plume-moths of the genus *Stenoptilia* of the French fauna, with study of the ♂ & ♀ genitalia. On p.99, "Stein 1887" is an error for Stein 1837. [P.V.]

Bigot, L., "Les *Aciptilia* de la faune française (Lep. Pterophoridae)" [in French]. *Alexanor,* vol.2: pp.247-254, 325-333, figs. 1962. Study of the French species. An "insular form" of *A. spicidactyla* from Malta is named *insularis,* p.254; described in *Lambillionea,* vol.61, p.49, 1961. [P.V.]

Bigot, L., "Les Pterophoridae des îles Seychelles (Lep.)" [in French]. *Bull. Soc. ent. France,* vol.67: pp.79-88, 9 figs. 1962. Study of collection made by Henry Legrand in the Seychelles. Describes as new *Platyptilia legrandi* (Mahe, Beau-Vallon). [P.V.]

Bigot, L., "Les *Oidaematophorus, Pterophorus* et *Adaina* de la faune française (Lep. Pterophoridae)" [in French]. *Alexanor,* vol.3: pp.25-32, 12 figs. 1963. Study of the French spp. of these genera of pterophorids, [P.V.]

Bleszyński, Stanislaw, "Omacnicowate — Pyralididae. Wachlarzykowate — Crambinae" [in Polish]. *Klucze do Oznacz, Owadów Polski,* vol.27, part 45b (no.18): 87 pp., 286 figs. 1956. See review in *Journal,* vol.15: p.132.

Bleszyński, Stanislaw, "Studies on the Crambidae. Part XX. Further investigations on the European species of the generic group *Crambus* s.l." [in English; Polish & Russian summaries]. *Acta zool. cracov.,* vol.4: pp.147-154, 2 pls. 1959. Describes as new *Agriphila hispanodeliella* (loc. typ. Spain, Albarracin). Notes on 12 further spp. and forms are given. [J.M.]

Bleszyński, Stanislaw, "Materialien zur Kenntnis der Crambidae (Lepidoptera). Teil XXVII. Über die Stellung von *Crambus lithargyrellus* var. *domaviellus* Rebel, 1904, und Beschreibung einer neuen Art vom Balkan" [in German]. *Zeitschr. wiener ent. Ges.,* vol.45: pp.169-172, 1 pl., 4 figs. 1960. *Catoptria domaviella,* n.comb. Describes as new *C. kasyi* ("Peristeri mons, Golemo ezero, 2200 m.", E. Macedonia). [P.E.]

Bleszyński, Stanislaw, "Miernikowce — Geometridae. Wstep i podrodziny Brephinae, Orthostixinae, Geometrinae, Sterrhinae" [in Polish]. *Klucze do Oznacz. Owadów Polski,* vol.27, part 46a (no.33): 149 pp., 446 figs. 1960. See review in *Journal,* vol.15: p.132.

Bleszyński, Stanislaw, "Studien über die Crambidae (Lepidoptera). Teil XXXI. Bemerkungen über einige Arten mit Beschreibungen von zwei neuen Gattungen und einer neuen Art" [in German]. *Zeitschr. wiener ent. Ges.,* vol.46: pp.33-38, 8 figs. 1961. Describes as new *PSEUDOCATHARYLLA* (type *Crambus flavoflabellus*); *ARGENTOCHILOIDES,* & type *A. xanthodorsellus* (Tanganyika, Matengo Highlands, WSW from Songea). Transfers several spp. to *Pseudocatharylla,* & sinks *Crambus mandarinellus* to *P. aurifimbriella;* notes & synonymy of *Euchromius ramburiellus* & *E. gratiosellus.* [P.B.]

Bleszyński, Stanislaw, "Studies on the Crambidae. Part XXVI. Preliminary study on the genus *Euchromius* Gn." *Acta ent. Mus. nation. Pragae,* vol.34: pp.451-468, 26 figs. 1961. As new are described: *E. viettei* (Arabia, Hejaz, Jidda), *E. gozmanyi* (Hispania & Tunisia), *E. mouchai* (Russia: Sarepta), *E. klimeschi* (Natal). Imagines & genitalia are figured. New synonyms: *E. superbellus* (=*Eromene wockeella;* =*Ommatopteryx cypriusella*). [J.M.]

Bleszyński, Stanislaw, "Studies on the Crambidae. Part XXX. On several species of the generic group *Crambus* F. from Ethiopian region with the descriptions of new genera and species" [in English; Polish summary]. *Bull. ent. Pologne,* vol.31: pp.165-207, 20 pls. with 81 figs. 1961. 33 spp. are discussed, of which 21 are described as new. The types mainly in British Museum (Natural History). New genera: *CAFFROCRAMBUS* (type *Crambus dichotomellus* Hampson); *ANOMOCRAMBUS* (type *homerus*); & *AUREOCRAMBOIDES* (type *apollo*). New species: *Crambus themistocles* (S. Africa, Natal, National Park), *C. sebrus* (Nyasaland, Mlanje Plateau), *C. archimedes* (Basutoland, Masseru; Transvaal & Natal also), *C. thersites* (Nairobi, E. Africa), *C. caligula* (Kampala to Ntebe), *C. pythagoras* (Angola: Caiala, Bihé), *C. aristophanes* (E. Africa: Escarpment & Kenya, Nakuru), *C. bellissimus* (Natal National Park), *C. guerini* (Tanganyika), *C. pseudosparsellus* (Mashonaland, Salisbury), *C. razowskii* (Cape Prov., Mossel Bay), *C. euripides* (Uganda: Ruwenzori Range), *C. icarus* (Kenya, Aberdare Range), *C midas* (Angola: Andulo, Bihé), *C. nephretete* (Angola: Bulubulu, Bihé), *C. ovidius* (Katanga: Biano), *C. cormieri* and *C. prometheus* (Tanganyika) *Caffrocrambus alcibiades* (Cape Prov., Mossel Bay); *Anomocrambus homerus* (Natal National Park); *Aureocramboides apollo* (E. Africa: Escarpment). *Crambus hampsoni* nom. nov. for *C. mediofasciellus* Hampson nec Zerny. [J.M.]

Bleszyński, Stanislaw, "Studies on the Crambidae (Lepidoptera). Part XXXVII. Changes in the nomenclature of some Crambidae with the description of new genera and species" [in English; Polish summary]. *Bull. ent. Pologne,* vol.32: pp.5-48, 31 figs 1962. A number of new combinations are recorded. New genera: *PSEUDOMETACHILO* (monotypic for *P. diatraeellus* Hmps.); *STYXON* (monotypic for *S. ciniferalis* Car.); *ZACATECAS* (monotypic for *Z. ankasokellus* Viette); *VAXI* (monotypic for *V. obliqua* Hamps.); *VELASQUEZ* (monotypic for *V. pentadactylus* Zell.); *VERONESE* (monotypic for *V. distinctellus* Leech). New spp.: *Pediasia simiensis* (Walamo, Prov. Soddu, Abyssinia), *P. niobe* (East Africa), *P. walkeri* (Kashmir, Pelain-India); new subspecies: *Crambus hortuellus sebdoui* (Sebdou, Algeria), *C. h. ussuriellus* (Jakovlevka- Ussuri,Amur, Hokkaido-Japan) New names: *Argyria vesta* (for *A. obliquella* Dyar, 1914); *Crambus xebus* (for *C. jucundellus* f. *uniformellus* Caradja, 1910). Genitalia of new spp. are figured. [J.M.]

Bourgogne, J., "Une espèce nouvelle du genre *Fumea* Haw. (Lep. Psychidae)" [in French]. *Alexanor,* vol.2: pp. 73-80, 10 figs., pl.III figs. 8-10. 1961. Describes as new *Fumea pyrenaea* (France, E. Pyrenees, Porté) & *F. p. occidentalis* (France, central Pyrenees, Pouey Aspé). After nomenclatorial considerations, the subfamily Psychinae auct. is named MEGALOPHANINAE, new name. [P.V.]

Bourgogne, J., "Une psychide d'Afrique peu connue, *Acanthopsyche sierricola* White" [in French]. *Bull. Inst. franç. Afr. noire* (*A*), vol.23: pp.485-492, 6 figs. 1961. A very poorly known psychid from Africa; redescription and figures of the lectotype, the ♂ genitalia, and a form. [P.V.]

Bourgogne, J., "Une psychide nouvelle de l'Afrique orientale (Lep.)" [in French]. *Bull. Soc. ent. France,* vol.65: pp.218-220, 11 figs. "1960" [1961]. Description of *Megalophanes majoropsis,* a psychid from British East Africa, Patta Island. [P.V.]

Bourgogne, J., "Un *Acanthopsyche* nouveau d'Afrique (Lep. Psychidae)" [in French]. *Bull. Soc. ent. France,* vol.67: pp.37-40, 8 figs. 1962. Describes as new *A. mixta* (N. W. Rhodesia, Solwezi, Kimbwi). [P.V.]

Boursin, Ch., "Eine für Spanien neue *Scotia-Art* (*Agrotis* auct.), *Scotia schawerdai* Byt.-Salz (="*Agrotis*" *santoruana* Hartig, nov. syn.) (Beiträge zur Kenntnis der Noctuidae-Trifinae, 106)" [in German]. *Zeitschr. wiener ent. Ges.*, vol.45: pp.68-70, 1 pl. 1960. Describes as new *S. s. balearica* (San Antonio, Ibisa, Pityusen Is.); comparison & figures of *Lithophane leautieri* sspp. & *Ochropleura mansoura hispanica*. [P.B.]

Boursin, Charles, "Drei neue paläarktische *Cryphia* Hb.-Arten (Beiträge zur Kenntnis der 'Noctuidae-Trifinae', 113)" [in German]. *Zeitschr. wiener ent. Ges.*, vol.46: pp.139-144, 1 pl. 1961. Describes as new *C. sugitanii* (Mt. Daisen, Japan); *C.* (*Bryoleuca*) *hannemanni* (Margelan, Russian Turkestan); *C. mongolica* (Schawyr, E. Tannuola region, Outer Mongolia, 2500 m.). Discusses spp. of *C.* (*Cryphia*) & *C.* (*Euthales*); sinks *C. stictica* to *C. receptricula* & *C. burgeffi* to *C. seladona*. [P.B.]

Boursin, Charles, "Eine neue *Chersotis* B. aus Griechenland (Beiträge zur Kenntnis der 'Noctuidae-Trifinae', 112)" [in German]. *Zeitschr. wiener ent. Ges.*, vol.46: pp.137-139, 1 pl. 1961. Describes as new *C. hellenica* (Megaspilion, 960 m., Peloponnesus, Greece). [P.B.]

Boursin, Charles, "Eine neue *Aegle* Hb. aus Anatolien (Beiträge zur Kenntnis der 'Noctuidae-Trifinae', 130)" [in German]. *Zeitschr. wiener ent.*, vol.47: pp.183-186, 2 pls. 1962. Describes as new *A. diatemna* (Mardin, E. Anatolia). Figures adults & genitalia of some related spp. [P.B.]

Boursin, Charles, "Eine enue *Cardepia* Hps. aus Turkestan (Beiträge zur Kenntnis der 'Noctuidae-Trifinae', 123)" [in German]. *Zeitschr. wiener ent. Ges.*, vol.47: pp.160-162, 1 pl. 1962. Describes as new *C. helix* (Aj-Darle, Syr-Darja, Russian Turkestan). [P.B.]

Boursin, Charles, "Eine neue *Hadena* Schrk. (*Dianthoecia* B.) aus Armenien (Beiträge zur Kenntnis der 'Noctuidae-Trifinae', 124)" [in German]. *Zeitschr. wiener ent. Ges.*, vol.47: pp.162-164, 1 pl. 1962. Describes as new *H. pygmaea* (Ak-Bulak, Armenia). Sinks *H. gemella, H. chosensis,* & *H. kogurei* to *H. dealbata*. [P.B.]

Boursin, Charles, "Eine neue *Mythimna* O. aus Südwestchina (Beiträge zur Kenntnis der 'Noctuidae-Trifinae', 122)" [in German]. *Zeitschr. wiener ent. Ges.*, vol.47: pp.140-141, 1 pl. 1962. Describes as new *M. anthracoscelis* (Kinfu-Shan, Si-Kang, SW China). [P.B.]

Boursin, Charles, "Eine neue *Subleuconycta* Kozh. (Apatelinae) aus Formosa (Beiträge zur Kenntnis der 'Noctuidae-Trifinae', 121)" [in German]. *Zeitschr. wiener ent. Ges.*, vol.47: pp.138-139, 1 pl. 1962. Describes as new *S. sugii*. [P.B.]

Boursin, Ch., "Note sur une espèce nouvelle pour la France metropolitaine et sur quelques captures intéressantes dans le Sud-Est (Lep. Noctuidae) [in French]. *Bull. mens. Soc. linn. Lyon,* vol.31: pp.136-137. 1962. *Amathes cohaesa* H.-S. a new species for the metropolitan French fauna and notes on *Paradiarsia punicea* Hb. & *Hydraecia petasitis* Dbld.; *stempfferi* Boursin, 1925 is a subspecies of *Calophasia lunula* Hfn. [P.V.]

Boursin, Ch., "Nouvelles races de Noctuidae paléarctiques, avec une note synonymique (Lep.) (Contributions à l'étude des 'Noctuidae-Trifinae', 120)" [in French]. *Bull. Mens. Soc. linn. Lyon,* vol.31: pp.302-305. 1962. Descriptions of new subspecies (and not "races") of palearctic noctuids: *Rhyacia nyctymerides alagesica* (Russian Armenia, Alagës Mts.); *Discestra stigmosa corsicola* (Corsica, St.-Florent); *Hadena luteocincta altamira* (Spain, Grenada, Sierra Nevada); *Metopoceras canteneri satanas* (S. Spain, Villamanrique); *Cryphia ereptricula hellenica* (Greece, Peloponnesus, Kalavryta); *Autophila osthelderi libanopsis* (Lebanon, Bscharré); *Pseudohadena arvicola rhodostola* (Syria, 20 km. NE from Damas). *Conistra danbei* Duponchel f. ind. *signata* Agenjo is a synonym of *C. gallica* Lederer. [P.V.]

Boursin, Ch., "Une nouvelle race de *Lithophane leautieri* B. d'Espagne (Lep. Noctuidae)" [in French]. *Bull. mens. Soc. linn. Lyon,* vol.31: p.251. 1962. Description of *L. l. andalusica* (Spain, Andalusia, Grenada). [P.V.]

Boursin, Charles, "Die *Isochlora* Stgr.-und *Grumia* Alph.-Arten aus Dr. h.c. Höne China-Ausbeuten (Beitrag zur Fauna Sinica) (Beiträge zur Kenntnis der 'Noctuidae-Trifinae', 135)" [in German]. *Zeitschr. wiener ent. Ges.*, vol.48: pp.122-127, 3 pls. 1963. Describes as new *G. carriei* (Batang, Si-kiang, alpine zone, 5000 m.). Discussion of *Isochlora viridis longivitta, I. straminea,* & *I. grumi;* lists the 9 known spp. of *Isochlora* (2 new synonyms) & figures genitalia of all. [P.B.]

Boursin, Charles, "Eine neue *Grumia* Alph. aus Sikkim (Beiträge zur Kenntnis der 'Noctuidae-Trifinae', 134)" [in German]. *Zeitschr. wiener ent. Ges.*, vol.48: pp.121-122, 1 fig. 1963. Deschibes as new *G. krausei* (Sebula Pass, 4800 m., N. Sikkim). [P.B.]

Boursin, Charles, "Eine neue *Hadula* Stgr. aus Zentralasien (Beiträge zur Kenntnis der 'Noctuidae-Trifinae', 131)" [in German]. *Zeitschr. wiener ent. Ges.*, vol.48: pp.43-45, 2 pls. 1963. Describes as new *H. leucheima* (Issyk-kul); figures of related spp. also. [P.B.]

Boursin, Charles, "Eine neue *Hydraecia* Gn. aus Marokko (Beiträge zur Kenntnis der 'Noctuidae-Trifinae', 136)" [in German]. *Zeitschr. wiener ent. Ges.*, vol.48: pp.127-128, 2 pls. 1963. Describes as new *H. rungsi* (Ifrane) & *H. r. gigantea* (Algiers). [P.B.]

Boursin, Charles, "Eine neue paläarktische Gattung der Unterfamilie Hadeninae (Lep. Noctuidae) (Beiträge zur Kenntnis der 'Noctuidae-Trifinae', 133)" [in German]. *Zeitschr. wiener ent. Ges.*, vol.48: pp.86-87, 2 pls. 1963. Describes as new *CARDIESTRA* (type *eremistis* Pglr.), including 3 spp.; comparison with *Discestra, Cardepia, Aglossestra,* & *Saragossa,* including figures of genitalia & front; sinks *Onychestra* to *Saragossa.* [P.B.]

Boursin, Charles, "Eine neue *Pseudohadena* Stgr. aus Chinesisch-Turkestan (Beiträge zur Kenntnis der 'Noctuidae-Trifinae', 131)" [in German]. *Zeitschr. wiener ent. Ges.*, vol.48: pp.38-40, 2 pls. 1963. Describes as new *P. oxybela* (Kuldzha); figures of related spp. also; sinks *P. adscripta* to *P. siri.* [P.B.]

Boursin, Ch., "Les Noctuidae de l'expédition féminine Claude Kogan au Cho-Oyu (Népal), 1959 (Lep.). Première contribution à l'etude de la faune des Noctuidae du Népal (Contributions à l'étude des Noctuidae Trifinae, 125)" [in French]. *Bull. mens. Coc. linn. Lyon,* vol.32: pp.20-22, 2 figs. 1963. List of some noctuids collected by the female expedition to Cho-Oyu and description of *Diarsia claudia* (Nepal, Sarkori Pati, 3750 m.). [P.V.]

Boursin, Ch., "Une espece de *Noctua* L. (*Triphaena* O.) europeenne et française, méconnue depuis 173 ans. *Noctua interposita* Huebner, 1789, nec 1790 (Lep. Noctuidae) (note préliminaire). Contributions à l'étude des 'Noctuidae-Trifinae', 126" [in French]. *Bull. mens. Soc. linn. Lyon,* vol.32: pp.72-79, 1 table. 1963. Discovery of a species of European noctuid disregarded for 173 years: *N. interposita* (=*consequa* Huebner, *sarmata* Rambur, *orbona nigra* Pieszczek). History, geographical distribution, and description of two subspecies: *N. i. baraudi* (E. Pyrenees, Les Ambollas), & *N. i. lajonquierei* (Spain, Sierra de Guadarrama, Puerto de Navacerrada). [P.V.]

Bradley, J. D., "Microlepidoptera collected by the Gough Island Scientific Survey 1955-56." *Entomologist,* vol.91: pp.178-180, 3 figs. 1968. Describes as new *Agonopterix goughi. Endrosis sarcitrella* & *Monopis crocicapitella* complete the known fauna. [P.B.]

Bradley, J. D., "The identity of certain species of Coleophoridae (Lepidoptera)." *Ent. Gazette,* vol.13: pp.173-184, 3 figs. 1962. Redefinition of spp., synonymy, & lectotype selections in *Coleophora.* [P.B.]

Bradley, J. D., "A review of the nomenclature of certain species in the genus *Elachista* Treitschke (Lep., Elachistidae)." *Ent. Gazette,* vol.14: pp.150-161, 6 figs. 1963. Redefinitions & figures of genitalia of *E. bisulcella* (=*zonariella*), *E. gangabella* (=*taeniatella,* n.syn.), *E. megerlella* (=*albinella?;* =*obliquella*), *E. unifasciella, E. adscitella,* & *E. cingillella* (=*densicornuella,* n.syn.); notes on

types & synonyms. *Phalaena cinctella* (=*Stomopteryx vorticella,* n.syn.), a gelechiid). [P.B.]

Bradley, J. D., "*Apotoma infida* (Heinrich) (Lep., Tortricidae) in the British Isles." *Ent. Gazette,* vol.14: pp.39-41. 1963. New record; compared to *A. semifasciana.* [P.B.]

Bradley, J. D., "*Sorhagenia rhamniella* (Zeller) (Lep., Momphidae) – a composite species." *Ent. Gazette,* vol.14: pp.41-44. 1963. Sinks *S. tolli* to *S. lophyrella;* descriptive notes on *S. lophyrella, S. rhamniella,* & *S. janiszewskae;* only the first and last have definitely been identified in Britain. [P.B.]

Breyer, Alberto, "Las especies argentinas del genero *Hesperocharis* Felder (Lepidoptera, Pieridae)" [in Spanish; English summary]. *Acta zool. lilloana,* vol.17: pp.45-51, 3 pls., 1 map. "1959" [1960]. Describes as new *H. angitia giesekingi* (Tucumán Prov., Argentina), and a new "form". Gives key to 7 spp. & sspp., with descriptive notes & synonymy. [P.B.]

deBros, Emmanuel, "*Chersotis fimbriola vallensis* n.ssp. (Lep. Noctuidae)" [in German]. *Nachrichtenbl. bayer. Ent.,* vol.11: pp.113-116, 8 figs. 1962. Type locality: Sierre-Geronde, Switzerland. [P.B.]

Brown, F. Martin, "A badlands subspecies of *Limenitis weidemeyeri* Edwards (Lepidoptera, Nymphalidae)." *Amer. Mus. Novit.,* no.2018: 6 pp., 4 figs. 1960. Describes as new *L. w. oberfoelli* (Badlands, Slope Co., North Dakota). Gives evidence that type locality of *L. weidemeyeri* is Front Range west of Denver, Colorado. [P.B.]

Brown, F. Martin, "A note about *Lycaena nivalis browni* (Lycaenidae)." *Journ. Lepid. Soc.,* vol.15: pp.107-108. 1962.

Brown, F. Martin, "Notes about the types of some species of butterflies described by William Henry Edwards." *Ent. News,* vol.73: pp.265-268. 1962. Probable location of some types; those of *Lycaena amica, L. pembina, Hesperia yuma,* and probably others, were destroyed. [P.B.]

Brown, F. Martin, "A neotype for *Coenonympha ochracea* Edwards (1861)." *Ent. News,* vol.74: pp.211-219. 1963. Selects specimen from Jefferson Co., Colorado, as neotype, as part of application to International Commission for rejection of Winnipeg specimen labelled as type by author; the reasons for the application are fully explained. [P.B.]

Brown, F. Martin, "*Coenonympha ochracea* Edwards, 1861 (Insecta, Lepidoptera): proposed designation of a neotype under the Plenary Powers." *Bull. zool. Nomencl.,* vol.20: pp.447-448. 1963. Specimen from Turkey Creek, Jefferson Co., Colo., proposed as neotype. [P.B.]

Brown, F. Martin, "The dates of publication of Lepidoptera, Rhopaloceres – Heteroceres by Herman Strecker." *Journ. Lepid. Soc.,* vol.18: pp.43-44. 1964.

Brown, F. Martin, "The W. H. Edwards types of Hesperiidae lost on the 'S. S. Pomerania' in 1878." *Ent. News,* vol.75: pp.24-25. 1964. Apparently only 7 specimens, including types of *Hesperia eos, H. nereus,* & *H. zampa* were lost [P.B.]

Buck, F. D., "Editorial notes on nomenclature." *Proc. S. London ent. nat. Hist. Soc.,* 1960: pp.155-158. 1961. Includes notes on revised names of some British spp. (butterflies, Sphingidae, noctuids, Coleophoridae). [P.B.]

Buck, F. D., "Editorial notes on nomenclature." *Proc. S. London ent. nat. Hist. Soc.,* 1961: pp.160-164. 1962. Includes notes on the nomenclature of some British spp. of Noctuidae, Geometridae, Pyralidae, & Tortricoidea. [P.B.]

Buckett, J. S., "Collecting of *Annaphila spila,* with notes on the 'crimson-winged' group of the genus." *Journ. Res. Lepid.,* vol.2: pp.303-304. "1963" [1964]. Comparison of *A. spila, A. evansi,* & *A. superba;* notes on habits & habitat of *A. spila* (Solano Co., Calif.). [P.B.]

Büttiker, W., "Notes on two species of Westermanniinae (Lepidoptera: Noctuidae) from Cambodia." *Proc. Roy. ent. Soc. London* (*B*), vol.31: pp.73-76, 6 figs. 1962. Describes as new *Arcyophora sylvatica* (Koc Cha Loch, 24 km. NE of Kampot); redescribes *Lobocraspis griseifusa.* The spp. were found feeding on lachrymal secretions of water buffaloes. [P.B.]

Butani, Dhamo K., "A key for the identification of sugarcane moth borers." *Indian Journ. Ent.*, vol.18: pp.303-304. 1956. A field key for 14 spp. of moths. [J.D.]

Cantlie, Keith, & T. Norman, "A new butterfly from Assam." *Journ. Bombay nat. Hist. Soc.*, vol.56: pp.357-358, 1 fig. 1959. Describes as new *Isma bonata* (Naga foothills, Sibsagar District, Assam, India). [J.D.]

Cantlie, Keith, & T. Norman, "Notes on the butterfly genus *Ypthima*." *Journ. Bombay nat. Hist. Soc.*, vol.56: pp.66-71, 12 figs. 1959. Describes as new *Y. atra* (Kangpokpi, Manipur, 4000 ft.) & ""forms" of *Y. watsoni* & *Y. akbar; Y. watsoni* & *Y. newara* good spp.; *Y. fusca* new to India (Assam). Figures & notes on other spp. [J.D.]

Cantlie, Keith, & T. Norman, ""Butterfly notes from Assam: the undescribed female of *Ypthima atra*." *Journ. Bombay nat. Hist. Soc.*, vol.58: p.296. 1961. Type locality as for the males (Kangpokpi, Manipur, India, 4000 ft.). Description of single ♀. [J.D.]

Cantlie, Keith, "Hesperiidae. *Halpe scissa* sp. nov." *Journ. Bombay nat. Hist. Soc.*, vol.58: pp.532-533, 4 figs. 1961. Type locality: East Dawnas, Burma. Thorough discussion of the genitalia of this & similar spp. [J.D.]

Cantlie, K., & T. Norman, " 'Notes on the butterfly genus *Ypthima*'." *Journ. Bombay nat. Hist. Soc.*, vol.58: p.532. 1961. Acknowledge that Shirozu separated *Y. newara* from *Y. nareda* before they did. [J.D.]

Capps, Hahn W., "Description of a new species of *Chilo* (Crambidae)." *Journ. Lepid. Soc.*, vol.17: pp.31-32, 4 figs. 1963. *C. erianthalis* (Port Blarre, La., reared on *Erianthus*).

Chang, Vincent C. S., "Quantitative analysis of certain wing and genitalia characters of *Pieris* in western North America." *Journ. Res. Lepid.*, vol.2: pp.97-125, 15 figs. 1963. Comparison of characters supports the distinctness of the 6 western spp., including *P. protodice* & *P. occidentalis*, which are respectively southern and northern with some overlap from central California to Oregon. [P.B.]

Christensen, G., "Om subspecier" [in Danish]. *Flora og Fauna*, vol.58: pp.43-44. 1952. Discusses the subspecies concept. [T.W.L.]

Clark, Gowan C., & C. G. C. Dickson, "Proposed classification of South African Lycaenidae from the early stages." *Journ. ent. Soc. southern Africa*, vol.19: pp.195-215, 15 pls. 1956. South African spp. are listed in a series of 18 unnamed "branches" which are shown in a tentative phylogenetic tree. Characters used are those of the egg and the first instar larva; characters are discussed and illustrated for the 84 spp. in which they are known. The egg is said to indicate the subfamily, but distinctive subfamily characters are not given. [P.B.]

Clark, Gowan C., & C. G. C. Dickson, "On the life-history of *Leptomyrina lara* (L.) and the reclassification of the Natal form, *gorgias* (Stoll) (Lepidoptera: Lycaenidae)." *Journ. ent. Soc. southern Africa*, vol.20: pp.333-335, 2 pls. 1957. *L. lara* & *L. gorgias* are regarded as distinct spp. because of differences in early stages, especially 1st instar larvae. All stages of both spp. are beautifully illustrated in color. [P.B.]

Clarke, J. F. Gates, "New species of Microlepidoptera from Japan." *Ent. News*, vol.73: pp.91-102, 3 pls. 1962. Describes as new: (Oecophoridae) *Psorosticha melanocrepida* (Kyûsyû, Ôita; on *Citrus unshiu*); *Agonopteryx chaetosema* (Honsyû, Kii, Nati; on *Fagara schinifolia*), *A. issikii* (Honsyû, Sinano Tabira; on *Orixa japonica*); (Gelechiidae) *Brachmia deodora* (Honsyû, Kinki, Sakai; on *Cedrus deodora*); *Gnorimaschema pervada* (Kyûsyû, Usuki, Ôita; on *Solanum lyratum*). [P.B.]

Clench, Harry K., "The *philobia* group of the genus *Cossula* (Lepidoptera: Cossidae)." *Ann. & Mag. nat. Hist.*, ser.13, vol.3: pp.407-416, 1 pl. 1961. Describes as new *C. wellingi* (Chichen Itza, Yucatan), *C. poecilosma* (Prov. del Sara, 450 m., central Bolivia), *C. eberti* (Ouro Branco, 1000-1100 m., Minas Geraës, Brazil); redescribes *C. morgani, C. interrogationis,* & *C. philobia;* notes on *C. alfarae*. Key to spp. [P.B.]

Clench, Harry K., "*Callophrys* (Lycaenidae) from the Pacific Northwest." *Journ. Res. Lepid.*, vol.2: pp.151-160, 2 figs. 1963. Describes as new *C. sheridani newcomeri* (Mill Creek, 1800 ft., Yakima Co., Washington). Discusses northwestern populations of *C. dumetorum*, and infraspecific variation and range of *C. sheridani*, including climatic factors which presumably limit its occurrence. [P.B.]

Clench, Harry K., "Further notes on West African Lycaenidae (Lepidoptera)." *Ent. News*, vol.74: pp.43-49. 1963. Describes as new *Aphnaeus chapini occidentalis* (Efulen, Cameroons). Places *A. asterius ugandae* as ssp. of *A. chapini*. Sinks *Cupidesthes brunneus* to *C. paludicola; Anthene musagetes* to *A. rubricincta*. Notes on some other forms belonging to these genera & to *Spindasis*. [P.B.]

Clench, Harry K., "A synopsis of the West Indian Lycaenidae with remarks on their zoogeography." *Journ. Res. Lepid.*, vol.2: pp.247-270, 10 figs. "1963" [1964]. Describes as new *NESIOSTRYMON* (type *Thecla celida shoumatoffi*); *HETEROSMAITIA* (type *Thecla bourkei*); *ALLOSMAITIA* (type *Thecla coelebs*). Systematic notes on *Callophrys crethona, Pseudolycaena, Electrostrymon, Leptotes, Hemiargus*, & *Brephidium*. Lists spp. known from West Indian islands. Discussion includes effects of low temperatures in Pleistocene & possible island origin of some mainland spp. [P.B.]

Collenette, C. L., "Entomological results from the Swedish Expedition 1934 to Burma and British India. Lepidoptera Hetercera: Lymantriidae, collected by Dr. Rene Malaise in Burma." *Ent. Tidskr.*, vol.81: pp.74-76, 3 figs. 1960. Describes as new *Euproctis malaisei* (NE Burma: Kambaiti, 7000 ft.); *Aroa kambaiti* (same), *Pantana azana* (same). [P.B.]

Collenette, C. L., "New African Lymantriidae (Lepidoptera, Heterocera)." *Ann. & Mag. nat Hist.*, ser. 13, vol.3: pp.91-101, 1 pl. 1960. Describes as new *Hyaloperina erythroma* (Njombe, 6000-6500 ft., Tanganyika); *SEVASTOPULOA* (monobasic), *S. celaenocera* (Mombasa, Kenya); *Olapa sobo* (Sobo Plain, near Sapele, Nigeria); *Stilpnaroma nasisi* (N. Kavirondo, Nasisi Hills, 4800 ft., Kenya); *Crorema mentiens phaulia* (Kumusi, Ashanti); *Carpenterella chionobosca* (Beamba, Uganda); *Paramarbla ansorgei* (Beni, Belgian Congo); *Euproctis carcassoni* (Mpanga Forest, Fort Portal, Uganda), *E. coniorta* (Kampala, Uganda), *E. macnultyi* (Port Harcourt, Nigeria); *Dasychira burtti* (Old Shinyanga, Tanganyika), *D. callipepla* (Gazi, near Mambasa, Kenya), *D. nyctopa* (Port Harcourt, Nigeria), *D. lipara* (Mpanga Forest, Fort Portal, Uganda), *D. aphanta* (Port Harcourt, Nigeria), *D. isozyga* (Port Harcourt), *D. anisozyga* (Sobo Plain, near Sapele, Nigeria), *D. proleprota cratista* (Mombasa, Kenya), *D. anoista* (Port Harcourt, Nigeria), *D. catadela* (Buea, S. Cameroons); *Rhypopteryx bowdeni* (Kawanda, Uganda), *R. hemichrysa* (Salisbury, S. Rhodesia). Note on *R. pachytaenia* ♂. Some new synonymy. [P.B.]

Collenette, C. L., "Some new Lymantriidae from the Congo." *Lambillionea*, vol.60: pp.95-106, 1 pl. 1960. Describes as new *Euproctis cerealces* (Kivu, Lvemba, Mukera), *E. aethodigmata* (Upper Kasai District); *Laelia lusambo* (Lusambo), *L. dochmia* (Sankuru, Katako-kombe); *Dasychira hodoepora* (Nigeria, Warri), *D. amydropa, D. phasa, D. polyploca* (Lusambo), *D. sociodes* (Uele, Paulis), *D. bokuma* (Equateur, Bokuma); *DYASMA* (type *Dasychira thaumatopoeides*); *Lomadonta callipepla* (Uele); *Rhypopteryx uele* (Uele), *R. fontainei* (Uele), *R. psoloconiama* (Ituri, Nioka). Notes & synonymy on some other spp. [P.B.]

Cottrell, C. B., "Two new subspecies of *Papilio jacksoni* E. Sharpe (Lepidoptera: Papilionidae) from Tanganyika and the Northern Rhodesia-Nyasaland border." *proc. Roy. ent. Soc. London (B)*, vol.32: pp.125-128, 1 pl., 1 map. 1963. Describes as new *P. j. kungwe* (Mt. Kungwe, W. Tanganyika), *P. j. nyika* (Nyika Plateau, Nyasaland); redefines & figures all sspp. of *P. jacksoni* & gives their distribution. [P.B.]

Coutin, R., "Les *Laspeyresia* des chatâignes et des glands. Etude biologique et morphologique de *L. splendana* (Hb.) et *L. fagiglandana* (Z.) (Lep. Olethreutidae)" [in French]. *Bull. Soc. ent. France*, vol.66: pp.21-26, 2 pls. 1961.

Biological and morphological study of two spp. of *Lespeyresia*, pests of chestnuts & acorns. [P.V.]

Covell, Charles V., "A revision of the neotropical genus *Erilophodes* (Lepidoptera: Geometridae)." *Ann. ent. Soc. Amer.*, vol.56: pp.835-844, 26 figs. 1963. Describes as new *E. spinosa* (Guaraní, Rio Grande do Sul, Brazil), *E. toddi* (Alto da Serra, Sao Paulo, Brazil). Redescribes type species, *E. colorata;* transfers *E. indistincta* to *Ischnopteryx*, *E. marmorinata* to *Neodesmodes* (synonym of *semialbata*), *E. arana* to *Neodesmodes*. [P.B.]

Crosson du Cormier, Alain, "*Boloria pales* Den. et Schiff. et *Boloria aquilonaris* St. dans la region des Hauts-Tatras" [in French]. *Acta faun. ent. Mus. nation. Pragae*, vol.7: pp.57-60, 6 figs. 1961. *B. p. tatrensis* ssp.n. (High Tatra & Liptov Mts., in N. Slovakia) is described. [J.M.]

Crosson du Cormier, A., & P. Guérin, "Les espèces du genre *Boloria* en France (Nymphalidae)" [in French]. *Alexanor*, vol.2: pp.41-48, 1 pl., 1 fig. 1961. A good study on the 4 spp. of *Boloria* (*B. pales, B. napaea, B. graeca,* & *B. aquilonaris*) occurring in France. [P.V.]

Crosson du Cormier, A., & P. Guérin, "*Boloria aquilonaris* Stichel en Pologne méridionale (Nymphalidae)" [in French]. *Alexanor*, vol.2: pp.236-238. 1962. *B. aquilonaris* in S. Poland and description of *B. a. podhalensis* n.ssp. (Podczerwone, Nowy-Targ district). [P.V.]

Daniel, Franz, "Bemerkungen zu einigen *Zygaena* — und *Dysauxes* Arten Mazedoniens" [in German; Macedonian summary]. *Acta Mus. Macadonici Scient. nat.*, vol.4: pp.211-222. 1956. *Z. filipendulae sharensis* ssp.n. (Shar planina, S. Yugoslavia), *Z. ramburi europensis* ssp.n. (Stary Dorian, S. Yugoslavia), *Z. ephialtes vardarica* ssp.n. (Shar planina, Vratnica, 900 m.); gives also redescription of *D. famula burgeffi* Draudt (neotypes from Stary Dorian). [J.M.]

Daniel, Franz, "Eine für das Alpengebiet neue *Procris*-Art: *P. albanica* Nauf. (Lep. Zygaenidae)" [in German]. *Nachrichtenbl. bayer. Ent.*, vol.9: pp.57-58. 1960. Record from S. Slovenia extends known range northwestard. Differences from related spp. are pointed out. [P.B.]

Daniel, Franz, "Monographie der palaearktischen Cossidae IV. Die Genera *Cossulinus* Kby., *Dyspessacossus* Dan. und *Isoceras* Tti. (Lep.)" [in German]. *Mitt. münchner ent. Ges.*, vol.50: pp.93-118, 2 pls., 3 figs. 1960. Revision of these genera, based mainly on the literature, from which original descriptions and other comments are quoted at length. Specimens examined are listed. Some forms previously placed in *Cossus, Hypopta* & *Holcoceras* are here included in the above genera. Generic assignment is based here on external characters, especially ♂ antennal structure; the author complains of the tendency to base classifications on single characters instead of on all important structures, but as before neglects genitalia entirely. [P.B.]

Daniel, Franz, Monographie der palaearktischen Cossidae V. Die Genera *PARAHYPOPTA* g.n., *Sinicossus* Clench und *Catopta* Stgr." [in German]. *Mitt. münchner ent. Ges.*, vol.51: pp.160-212, 2 pls., 10 figs. 1961. Describes as new *PARAHYPOPTA* (type *caestrum* Hbn.); the type of *Hypopta* is *ambigua*. All palearctic spp. of these genera treated, with original descriptions repeated; figures of most. [P.B.]

Daniel, Franz, "*Spilarctia karakorumica* sp.n. (Lep., Arctiidae)" [in German]. *Mitt. münchner ent. Ges.*, vol.51: p.159, 1 fig. 1961. Type locality "N.W. Karakorum, Gilgit, Banidas 2600 m." [P.B.]

Daniel, Franz, "Besprechung einiger *Zeuzera*-Formen Ost — und Südostasiens (Lepidoptera — Cossidae)" [in German]. *Zeitschr. Arbeitsgem. österr. Ent.*, vol.14: pp.6-9, 1 pl. 1962. Describes as new *Z. nepalense* (Tukucha, Nepal; records of *Z. pyrina* & *Z. multistrigata,* with taxonomic notes. [P.B.]

Davis, Donald R., "Bagworm moths of the western hemisphere." *U.S. nat. Mus. Bull.*, no.244: 233 pp., 385 figs. 1964. Describes as new *NAEVIPENNA* (type *Platoeceticus aphaidropa,* monobasic); *LUMACRA* (type *Eumeta brasiliensis*), *L. haitiensis* (Port-au-Prince, Haiti), *L. quadridentata* (St. Jean de Maroni,

French Guiana), *L. hyalinacra* (Juayua, El Salvador); *CURTORAMA* (type *Psyche cassiae,* monobasic); *ASTALA* (type *Psyche confederata*); *BASICLADUS* (type *Eurycyttarus tracyi*); *COLONEURA* (type *Apterona fragilis,* monobasic); *Animula* (*ARTIPENNA*) (type *Thyrdiopteryx seitzi*); *Oiketicus* (*PARAOIKETICUS*) (type *O. geyeri*). Revision of Psychidae of the new world, based mainly on male structure. 55 spp. & 2 sspp. are treated systematically; 19 others, whose males are unknown or could not be examined, are discussed in an appendix; the remaining 28 names used for this group are synonyms, many of them new. The American founa is made up of specialized types; only *Solenobia walshella* (possibly introduced) represents the primitive "Micro-Psychina". Characters of early stages are discussed, but are said to be of little value in classification; female characters are not correlated with those of males. The larvae are notoriously polyphagous. [P.B.]

Diakonoff, A., "Opmerkingen over het genus *Cryptaspasma* (Lepidoptera, Olethreutidae)" [in Dutch; English summary]. *Ent. Berichten,* vol.20: pp.17-19. 1960. Summary of his revision of pantropical genus. [P.B.]

Diakonoff, A., "Records and descriptions of exotic Tortricoidea (Lep.)." *Ann. Soc. ent. France,* vol.130: pp.49-76, 1 pl., 31 figs. 1961. Describes as new *Adoxophyes novohebridensis* (New Hebrides), *A. rhopalodesma* (Waigeu Is.); *XENEDA,* & type species *X. coena* (New Caledonia); *Xenothictis noctiflua* (New Hebrides); *Lobesia embrithes* (Mauritius); *CONIOSTOLA* (type species *Eucosma stereoma* Meyr.); *PERITRICHOCERA,* & type species *P. bipectinata* (La Réunion). [P.V.]

Diakonoff, A., "Ergebnisse der Zoologischen Nubien-Expedition 1962. Teil XVI. Lepidoptera; Tortricidae, Olethreutinae" [in German]. *Ann. naturhist. Mus.Wien,* vol.66: pp.473-476, 1 pl., 3 figs. 1963. Describes as new *Bactra legitima insignis* (Wadi Halfa, Nubia). Describes ♂ & ♀ genitalia of *Laspeyresia refrigescens.* Sinks *Bactra truculenta* & *B. banosii* to *B. venosana;* notes on *B. graminivora.* [P.B.]

Diakonoff, A., "Tortricidae from Madagascar in the Berlin Museum." *Deutsche ent. Zeitschr.,* N. F., vol.8: pp.152-155, 3 figs. 1961. Describes as new *Parapandemis croceocephala* (Betsileo country, S. central Madagascar). Records of 11 other spp. [P.B.]

Dufay, Claude, "Les *Abrostola* O. (*Unca* auct.) de la collection du Museum National de Prague" [in French]. *Acta faun. ent. Mus. nation. Pragae,* vol.5: pp.43-47. 1959. The localities of 4 central European spp. are recorded. The key for the determination of these spp. is given. [J.M.]

Dufay, C., "Description d'une nouvelle espece de *Plusia* auct. sensu lato des Balkans (Lep. Noctuidae, Plusiinae) (note préliminaire) (Contribution à l'étude des Noctuidae 'Quadrifinae', XV)" in French. *Bull. mens. Soc. linn. Lyon,* vol.30: pp.5-6. 1961. Describes as new *P. chlorocharis* (central Macedonia, Drenovo near Kavadar). Note the abnormal length of the title of this paper! [P.V.]

Dufay, Cl., "Les *Nycteola* Hübner (*Sarrothripus* Curtis) de la Collection Staudinger. Description d'une espèce nouvelle d'Asie centrale et antérieure (Lep. Noct.)" [in French]. *Deutsche ent. Zeitschr.,* N. F., vol.8: pp.431-440, 5 figs. 1961. Describes as new *N. degenerana eurasiatica* (Moscow), *N. eremostola* (Saisan, Tarbagatai, SW Altai). Review of material of the 7 Old World spp. in this collection. [P.B.]

Dufay, C., "Descriptions de trois nouvelles espèces d'*Euchalcia* Hb. d.Asie anterieure (Lep. Noctuidae Plusiinae) (note preliminaire)" [in French]. *Bull. mens. Soc. linn. Lyon,* vol.32: pp.68-72. 1963. Describes as new *E. hyrcaniae* (N. Persia, Elbours Mts., Sardab valley, Tacht i Suleiman), *E. chalcophanes* (same locality), *E. phrygiae* (Anatolia, Tschiftlik, Akschehir). [P.V.]

Ebert, Günter, "Vorkommen und Verbreitung einiger schwierigerer Rhopaloceren-Arten in Nordbayern" [in German]. *Nachrichtenbl. bayer. Ent.,* vol.10: pp.49-56, 59-67, 23 figs. 1961. Points out distinguishing characteristics of *Melitaea athalia, M. britomartis,* & *M. parthenie;* map shows records of latter 2 spp. in N. Bavaria. Discusses characters of *Maculinea alcon* and their variation; regards *M. rebeli* as at most an alpine subspecies; map shows Bavarian records of *M. alcon.* [P.B.]

Ebert, Günther, "*Melitaea parthenoides* (=*parthenie* auct., nec Bkh.), ein sicherer Neufund für Nordbayern" [in German]. *Nachrichtenbl. bayer. Ent.*, vol.11: pp.81-87, 4 figs., 1 map. 1962. Distinguishes *M. parthenoides* from *M. parthenie, M. athalia, M. britomartis;* summarizes distribution. [P.B.]

Ehrlich, Paul R., "A note on the systematic position of the giant lycaenid butterfly *Liphyra brassolis* Westwood (Lepidoptera: Papilionoidea)." *Pan-Pacific Ent.*, vol.36: pp.133-135. 1960. On morphological characters, which are listed, this species is a normal member of the Lycaeninae in Ehrlich's sense. [P.B.]

Ehrlich, Paul R., Anne H. Ehrlich, et al., *How to know the butterflies.* 262 pp., 525 figs. Dubuque, Iowa: Wm. C. Brown Co. 1961. An illustrated key to all spp. of Papilionoidea known from America north of Mexico. Structural characters, including genitalia, are used when important for certain identification. Morphology of adults is described, and the index includes an illustrated glossary. Various specialists have contributed certain sections; in Melitaeini, D. L. Bauer describes as new *POLADRYAS* (type *Melitaea pola*); in Theclini, H. K. Clench describes as new *CHLOROSTRYMON* (type *Thecla telea*), *PHAEOSTYMON* (type *T. alcestis*), *MINISTRYMON* (type *T. leda*), *XAMIA* (type *Mitoura xami*), *CYANOPHRYS* (type *Strymon agricolor*), *EURISTRYMON* (type *Thecla favonius*), *HYPOSTRYMON* (type *T. critola*), *ELECTROSTRYMON* (type *Papilio endyminon*). There are some new or unfamiliar combinations, particularly in these two tribes. See review in *Journal,* vol.14: pp.201-202. [P.B.]

Eliot, J. N., "A new species of *Potanthus* (Hesperiidae) and some other butterflies from Malaya." *Entomologist,* vol.93: pp.241-245, 2 figs. 1960. Describes as new: (Satyridae) *Erites medura russelli* (Malaya, Selangor, Ulu Gombak, 16th milestone); (Nymphalidae) *Euthalia eriphylae raya* (Malaya, Langkawi Islands); (Hesperiidae) *Potanthus chloe* (Malaya, Perak, Maxwell's Hill, 4000 ft.); also a "form" of *Deudorix* (Lycaenidae). Notes on spp. & sspp. confused under the name *Neptis nata.* Describes ♀ of *Celastrina cyma.* [P.B.]

Eyer, John R., "A pictorial key to the North American moths of the family Opostegidae." *Journ. Lepid. Soc.,* vol.17: pp.237-242, 2 pls. 1964.

Fletcher, D. S., & P. Viette, "Descriptions de trois nouveaux genres de noctuelles trifides (Lepid.)" [in French]. *Bull. mens. Soc. linn. Lyon,* vol.31: pp.5-7. 1962. Descriptions of *MABILLEANA* (Noctuinae), type species: *Agrotis pudens* Mabille; *SAALMUELLERANA* (Hadeninae), type species: *Dianthoecia glebosa* Saalmüller; *BERIOANA* (Amphipyrinae), type species: *Trachea limbulata* Berio. [P.V.]

Fletcher, D. S., "Macrolepidoptera collected by the Gough Island Scientific Survey 1955-56." *Proc. Roy. ent. Soc. London (B)*, vol.32: pp.17-19, 4 figs. 1963. Describes as new *Dimorphonoctua goughensis* & *Peridroma goughi,* brachypterous endemics, and records *P. porphyrea* & *Othreis apta.* [P.B.]

Forster, Walter, "Bausteine zur Kenntnis der Gattung *Agriodiaetus* Scudd. (Lep. Lycaen.) II" [in German]. *Zeitschr. wiener ent. Ges.,* vol.45: pp.105-142; vol.46: pp.8-13, 38-47, 74-78, 88-94, 110-116; 6 pls. 1960, 1961. Describes as new *A. actis pseudactis* (Armenia, Daralagez Mts., pag. Martiros, 200 m.), *A. a. praeactinides* (Karatau Mts., pag. Vyssokoje, Prov. Syr-Darja), *A. iphigenia rueckbeili* (E. Turkestan, Aksu), *A. phyllis zeituna* (Zeitun, Antitaurus), *A. p. sheljuzhkoi* (Armenia, Daralagez Mts., pag. Azizbekov, 1650 m.), *A. p. dagestanica* (Dagestan, pag. Chodzhal-machi, Dargi District), *A. p. askhabadica* (Transcaspia, Kuschka), *A. hopfferi malatiae* (W. Kurdistan, near Malatya), *A. hamadanensis splendens* (Iran, Elburs Mts., Keredji, 1800 m.), *A. dolus ainsae* (Ainsa, Pyrenees, Spain), *A. antidolus kurdistanica* (Kurdistan, near Wan, Erek Dagh, 2000-2500 m.). Monographic treatment of these spp. and 6 related ones; all but 3 forms are figured. [P.B.]

Forster, Walter, "Presidential address to the Tenth Annual Meeting of the Lepidopterists' Society." *Journ. Lepid. Soc.,* vol.15: pp.57-62. 1961.

Fox, Richard M., "A check list of the Ithomiidae. I. Tribes Tithoreini and Melinaeini." *Journ. Lepid. Soc.,* vol.15: pp.25-33. 1961.

Fox, Richard M., "Affinities and distribution of Antillean Ithomiidae." *Journ. Res. Lepid.*, vol.2: pp.173-184, 12 figs. 1963. Sinks *Greta* Hemming to *Hymenitis*. Describes as new *H. diaphana quisqueya* (Mt. Diego de Ocampo, Dominican Republic, 3000-4000 ft.). Suggests that the 2 Antillean spp. arrived in the islands via an Oligocene land bridge. [P.B.]

Franclemont, John G., "*Zale perculta* species nov. Insecta: Lepidoptera: Noctuidae: Catocalinae." *Pilot Register of Zoology*, card no.1. 1964. Reared from larvae collected at Waycross, Georgia, on *Ampelothamnus phillyreifolius*. Description, with colored figures of adult and larva and drawings of genitalia, published on a punched card, part of an experimental series issued by the Department of Entomology, Cornell University. [P.B.]

Freeman, H. A., "*Megathymus yuccae* in Texas, with the description of two new subspecies." *Journ. Lepid. Soc.*, vol.17: pp.89-99, 8 figs., 1 map. 1963. Describes as new *M. y. reinthali* (Ben Wheeler, Texas), *M. y. louiseae* (16 mi. N. of Del Rio, Texas).

Friese, Gerrit, "Beitrag zur Kenntnis der ostpaläarktischen Yponomeutidae (Lepidoptera)" [in German]. *Beitr. Ent.*, vol.12: pp.299-331, 32 figs. 1962. Study of 16 spp. from Japan & China, with descriptions & figures of wing pattern, & genitalia of some; several new synomyms. *Homadaula anisocentra* (=*Hyponomeuta usuguronis*) transferred to *Paraprays* (Plutellidae). The 44 spp. recorded from this region are listed, with their distribution. [P.B.]

Gaj, Andrew J., "Notes on Pterophoridae. *Platyptilia metzneri* Zell. and related species." *Ent. Berichten*, vol.19: pp.150-158, 15 figs. 1959. Describes as new *P. catharodactyla* (Tarbagatai Mts., central Asia). Redescribes *P. metzneri, P. terminalis,* & *P. taprobanes.* [P.B.]

Gozmány, L. A., "Neue Kleinschmetterlinge I" [in German]. *Folia ent. hung.*, vol.4: pp.17-24, 2 figs. 1951. *Sophronia ascalis* sp. n. (Pásztó, district Nógrád, Hungary); *Metzneria xanthorhabda* sp.n. (Budapest and Kaposvár in Hungary); *Heterographis eremita* sp.n. (Tripolitania Garian & Bisira). [J.M.]

Gozmány, L. A., "New Microlepidoptera II" [in English]. *Folia ent. hung.*, vol.4: pp.69-72, 2 figs. 1951. *Eupista* (*Coleophora*) *edithae* sp.n. (Budapest and environs). Describes also the ♀ of *E.* (*C.*) *predotella* Rebel (Deliblato in I. Yugoslavia). [J.M.]

Gozmány, L. A., "Records on Microlepidoptera" [in English; Russian summary]. *Ann. hist.-nat. Mus. nation. hung.*, vol.52: pp.423-428, 2 figs. 1960. Describes as new *Scythris ruehli* (Buyuk Ada, Sea of Marmora, near Istanbul); *Paradoxus lushanensis* (Lu-Shan, Tian-Tsi, China). Discusses genera of Hofmanniinae (Plutellidae), regarding *Paradoxus, Zelleria, Hofmannia,* & *Xyrosaris* as distinct & valid. Describes genitalia of first known ♂ of *Tetanocentria ochraceella.* [P.B.]

Gozmány, L. A., "The results of the zoological collecting trip to Egypt in 1957, of the Natural History Museum, Budapest. 8. Egyptian Microlepidoptera II" [in English; Russian summary]. *Ann. hist.-nat. Mus. nation. hung.*, vol.52: pp.411-421, 4 figs. 1960. Describes as new *NEFERTITIA* (monobasic), *N. candida* (Hurghada, on Red Sea); *NYLONALA* (monobasic), *N. infidelis* (Cairo); *Bactra banosii* (Sohag, Egypt); *Gnorimoschema infallax* (Hurghada), *G. tractatum* (Kom Osim, Fayum distr., Egypt); *Cosmopteryx superba* (Sohag); *Ascalenia satellitia* (Idfu, Egypt); *Acrocercops imperfecta* (Sids, Egypt); *Tischeria noviciata* (Hurghada). Annotated list of 59 spp. in all. [P.B.]

Gozmány, L. A., "The description of some new symmocoid taxa (Lepidoptera: Gelechiidae)." *Acta zool. Acad. Scient. hung.*, vol.7: pp.97-110, 2 figs. 1961. Describes as new *Symmoca torrida* (Lanjaron); *Apromintа nausikaa* (Attika), *A. separata* (Kristallenia, Crete), *A. africana* (Xauen-A'Faska, 1360 m., Mauretania): *HECESTOPTERA* (monobasic), *H. kyra* (Kurdistan, Wan, 2000 m.); *Amselina astuta* (Aragon, Albarracin); *Donaspastus fallax* (Andalusia, Granada); *Eremica emir* (Asia Minor, Akschehir-Tschiftlik). Discusses identity & synonymy of some *Symmoca* spp. Sinks *Asbolistis* & *Exorgana* to *Ceuthomadarus* (Timyridae) & discusses spp. of latter genus. Checklist of *Symmoca* complex. [P.B.]

Gozmány, L., "Zoologische Ergebnisse der Mazedonienreisen Friedrich Kasys. III. Teil. Lepidoptera: Gelechiidae" [in German]. *Sitzungsber. österr. Akad. Wiss., math.-naturw. Kl., Abt. I,* vol.170: pp.313-314. 1961. Describes as new *Eremica kasyi* (Skopje, Macedonia). [P.B.]

Gozmány, L. A., "New and interesting symmocoid species in the zoological collection of the Bavarian State, Munich, Germany (Lep. Gelechiidae)." *Opusc. zool.,* Munich, no.64: 6 pp., 5 figs. 1962. Describes as new *Symmoca italica* (Mt. Sabini, Tivoli, Italy), *S. sattleri* (Tarragona, E. Spain); *Aprominta aga* (Aksehir, 1200 m., central Anatolia); *EREMICAMURA,* & type *E. mercuriata* (Amur, E. Asia). Records of 13 other spp. of Symmocinae. [P.B.]

Gozmány, L. A., "On the genus *Paradoris* Meyr., and some notes on symmocoid taxa (Lepidoptera: Gelechiidae)." *Acta zool. Acad. Scient. hung.,* vol.8: pp.39-65, 19 figs. 1962. Proposes *KERTOMESIS* (type *anaphracta* Meyrick) to replace *Paradoris,* preoccupied. Describes as new *Symmoca sultan* (Motril, Spain); *Amselina burmanni* (Granada, Spain), *A. altitudinis* (Noguera, Albarricin, 1600 m., Spain); *Donaspastus erroris* (El Kantara, Algeria). Descriptive notes, mainly on genitalia, on 13 spp. of *Kertomesis* & on *Symmoca maschalista, Donaspastus epentheticus,* & *Syrmadaula alacris.* Describes & figures ♀ genitalia of 16 spp. (in *Symmoca, Thanatovena, Donaspastus, Hamartema, Amselina,* & *Eremica*) in which ♂ & ♀ have been matched. Sinks *Thanatovena aegrella* to *T. canariensis.* Notes on confusion of *Donaspastus calidella, D. molitor,* & *D. obliterata.* [P.B.]

Gozmány, L. A., "The family SYMMOCIDAE and the description of new taxa mainly from the Near East (Lepidoptera)." *Acta zool. Acad. Scient. hung.,* vol.9: pp.67-134, 71 figs. 1963. Raises group (of gelechiids) to family level. Describes as new: *NUKUSA* (type *Lampros praeditella*); *GIGANTOLETRIA* (monobasic), *G. amseli* (Shiraz, Fars, Persia); *SYMMOLETRIA* (monobasic), *S. sulamit* (near Batrun, Lebanon); *MEGASYMMOCA,* & type *M. forsteri* (Pir-i-zan, Iran), *M. sahname* (Shiraz, SW Iran), *M. sheherezade* (6000 ft., Shiraz), *M. persica* (Sineh Sefid, Iran), *M. mithridates* (6000 ft., Shiraz), *M. satrapa* (Pir-i-zan, Iran), *M. mithra* (Sineh Sefid, Iran), *M. sindbad* (Sine Sefid), *M. maga* (Shiraz); *Symmoca striolatella* (Tacht i Suleiman, Vandarban Valley, Elburs, Persia), *S. salem* (Kyrenia, Cyprus); *SYMMACANTHA* (type *Symmoca sparsella*); *Aprominta aladdin* (60 km. NE of Ladikije, Syria); *HIERONALA* (monobasic), *H. huri* (Sarobi, 1100 m., E. Afghanistan); *XENOPLAXA* (monobasic), *X. saraf* (20 km. NE of Damascus, Syria); *Amselina acantha* (Aritzo, Sardinia); *PECTENEREMUS* (type *Eremica albella, =grisella,* n.syn.), *P. padishah* (Riad, 700 m., central Arabia), *P. pilatus* (Sineh Sefid, Iran), *P. pharaoh* (Laghouat, Algeria); *KULLASHARA* (type *Eremica kalifella*); *Donaspastus don* (Escorial, Spain), *D. demon* (La Bessée, L'Argentière, Hautes Alpes, France), *D. djinn* (near Batrun, Lebanon); *Eremica eremita* (Pir-i-zan, Iran), *E. effendi* (Shiraz, Iran), *E. wiltshirei* (7000 ft., Shiraz Mts., Fars, Persia), *E. pantsa* (Sveti Rasmo, L. Ochrid, Yugoslavia); *LEILAPTERA* (type *Eremica lithochroma*); *SYSSYMMOCA* (monobasic), *S. sahib* (1000 ft., Dalaki Brisge, Fars, Persia). Redescribes *Stibaromacha,* several spp. of *Symmoca, Aprominta virginella, Pecteneremus albellus,* & *Oecia.* The family extends from the Mediterranean region to India & South Africa, in warm day localities; many forms probably remain to be discovered. [P.B.]

Grey, L. P., & A. H. Moeck, "Notes on overlapping subspecies. I. An example in *Speyeria zerene* (Nymphalidae)." *Journ. Lepid. Soc.,* vol.16: pp.81-97, 2 maps. 1962.

Grey, L. P., A. H. Moeck, & W. H. Evans, "Notes on overlapping subspecies. II. Segregation in the *Speyeria atlantis* of the Black Hills (Nymphalidae)." *Journ. Lepid. Soc.,* vol.17: pp.129-147, 1 pl., 3 maps. 1963.

Groth, K., "Om vor *Boloria-art*" [in Danish]. *Flora og Fauna,* vol.58: pp.105-106. 1952. Discusses the correct scientific name for *Boloria arsilache.* [T.W.L.]

Guillaumin, M., "Etude des formes intermédiaires entre *Pyrgus malvae* L. et *P. malviodes* Elw. et Edw. (Lep. Hesperiidae)" [in French]. *Bull. Soc. ent. France,*

vol.67: pp.168-173, 8 figs. "1962" [1963]. Studies of the intermediate forms between these spp. in France, with descriptions of the ♂ and ♀ genitalia. [P.V.]

Hackman, Walter, "Die finnischen *Sorhagenia* Arten (Lepid., Momphidae)" [in German]. *Notul. Ent.*, vol.43: pp.45-49, 9 figs. 1963. Redescribes *S. janiszewskae* & *S. tolli* & gives records.]P.B.[

Haggett, G., "*Eupithecia innotata* Hufnagel and *Eupithecia fraxinata* Crewe (Lep., Geometridae). *Ent. Gazette*, vol.14: pp.13--23. 1963. Concludes that these are distinct spp. (though morphologically indistinguishable), feeding on *Artemisia* and *Hippophae* respectively, and that *E. innotata* does not occur in Britain. [P.B.]

Hannemann, H. J., "Eine neue *Scythris* aus dem Naturschutzgebiet bei Oberweiden im Marchfeld, Niederösterreich (Lep., Scythr.)" [in German]. *Zeitschr. Arbeitsgem. österr. Ent.*, vol.14: pp.39-40, 2 figs. 1962. Destribes as new *S. kasyi.* [P.B.]

Hanson, Bror, "Bidrag till kännedom om Gotska Sandöns fjärilsfauna. I" [in Swedish; descriptions in English]. *Ent. Tidskr.*, vol.83: pp.123-134, 3 figs. 1962. Describes as new *Boarmia lichenaria distinctaria;* names an aberration of *Agrotis vestigialis.* Annotated list of over 200 spp. (32 families) from Swedish island. [P.B.]

Hanson, Bror, "Bidrag till kännedomen om Gotska Sandöns fjärilfauna. II *Horisme aemulata* Hb. (Lep. Geom.), ny art för Norden. De nordiske *Horisme*-Arten" [in Swedish; English summary]. *Ent. Tidskr.*, vol.84: pp.216-220, 3 figs. 1963. Key to the 5 Scandinavian spp. & descriptions of ♀ genitalia. *H. aemulata* new to Scandinavia. [P.B.]

Harbison, Charles F., "A second new species of megathymid from Baja California, Mexico (Lepidoptera: Megathymidae)." *Trans. San Diego Soc. nat. Hist.*, vol.13: pp.61-70, 20 figs. 1963. Describes as new *Agathymus dawsoni* (N. of Punta Prieta; reared from *Agave goldmaniana*). [P.B.]

Hayward, Kenneth J., "Catalogo sinonimico de ropaloceros argentinos excluyendo Hesperiidae (segundo suplemento)" [in Spanish; English summary]. *Acta zool. lilloana*, vol.16: pp.13-21. 1958. Includes 14 additions or changes of name, 4 deletions, some new synonymy & changes of generic assignment, & other corrections. [P.B.]

Hayward, Kenneth J., "Dibujos de los genitales masculinos de algunos satiridos neotropicales (Lep. Rhop. Satyridae)" [in Spanish; English summary]. *Acta zool. lilloana*, vol.16: pp.61-81, 72 figs. 1958. Figures of ♂ genitalia of 72 spp. of satyrids from Bolivia & other Latin American countries. [P.B.]

Hayward, Kenneth J., "Satiridos argentinos (Lep. Rhop. Satyridae) II. Los géneros (continuación)" [in Spanish; English summary]. *Acta zool. lilloana*, vol.15: pp.161-181, 3 figs. 1958. Redescribes *Euptychia* (*herse*), *Tetraphlebia* (*germaini*, type sp.), & *Neosatyrus* (*ambiorix*, type sp.); repeats original description of *Neomaniola.* Gives notes on Argentine spp. of *Euptychia, Taygetis, Cosmosatyrus, Faunula, Lymanopoda,* & *Pedaliodes;* transfers *Faunula johanna* to *Pampastyrus; Neosatyrus humilis, boisduvalii, vesagus,* & *shajovskoi* to *Homoeonympha.* [P.B.]

Hayward, Kenneth J., "Satiridos argentinos (Lep. Rhop. Satyridae) III. Guia para su clasificación" [in Spanish; English summary]. *Acta zool. lilloana*, vol.15: pp.199-296, 8 pls., 85 figs. 1958. Keys to subfamilies, genera, & spp., brief descriptions emphasizing distinctive features, & figures of wings & ♂ genitalia of most spp. of Argentine Satyridae. [P.B.]

Hayward, Kenneth J., "Catalogo sinonimico de ropaloceros argentinos excluyendo Hesperiidae. Tercero suplemento" [in Spanish; English summary]. *Acta zool. lilloana*, vol.18: pp.19-30. 1962. Includes additional forms, deletions, changes of status or generic assignment, & additional records, mainly in Pieridae & Satyridae. [P.B.]

Hayward, Kenneth J., "Dibujos de genitales masculinos de algunos satiridos neotropicales (Lep. Rhop. Satyridae) II" [in Spanish; English summary]. *Acta zool. lilloana*, vol.18: pp.251-257, 23 figs. 1962. Figures of ♂ genitalia of 23 spp. from South America, with synonymy & localities. [P.B.]

Hayward, Kenneth J., "Satiridos argentinos (Lep. Rhop. Satyridae) IV. Adiciones" [in Spanish; English summary]. *Acta zool. lilloana*, vol.18: pp.11-17, 1 fig. 1962.

Describes as new *Euptychia inornata* (Pelotas, Rio Grande do Sul, Brazil); *E. gibsoni* (Playadito, near Ituzaingó, Corrientes); *Tetraphlebia garmaini argentina* (Pucará, Parque Nacional Lanin, Argentina). Redescribes *E. ocelloides* & *E. narapa*. [P.B.]

Hayward, Kenneth J., "'Satiridos sudamericanos nuevos (Lep. Rhop. Satyridae)" [in Spanish English summary]. *Acta zool. lilloana,* vol.17: pp.105-109, 4 figs. 1962. Describes as new *Euptychia howarthi* (Bolivia, Chapare, Yungas); *E. saltuensis* (locality unknown); discusses *Manerebia cyclopina monops.* [P.B.]

Heitzmann, T. J., "Estudo do ♂ de *Copaxa decrescens* Walker, 1855. (Lep. Satyridae)" [in Portuguese; English summary]. *Pap. avuls. Dep. Zool. Sao Paulo,* vol.13: pp.275-295, 34 figs. 1959. Very detailed description of pattern, external morphology, & genitalia. [P.B.]

Hemming, Francis, "Reduction of the name *Pseudoliptena* Stempffer, 1940, to the status of a junior objective synonym of *Anthene* Doubleday, 1947 [sic!] (Lep.: Lycaenidae)." *Entomologist,* vol.96: pp.292-293. 1963. *P. bitje* Stempffer is based on a composite specimen most of which is probably *A. lachares.* [P.B.]

Herbulot, C., "Nouveaux *Xenimpia* d'Afrique orientale, des Comores et de Madagascar (Lep. Geometridae)" [in French]. *Bull. mens. Soc. linn. Lyon,* vol.30: pp.145-147. 1961. Description of 4 new spp.: *X. crassipecten* (Comoro Islands, Mohéli), *X. luxuriosa* (Comoro Islands, Grand Comoro), *X. transmarina* (E. Madagascar, Moramanga area), *X. dohertyi* (British E. Africa, Escarpment). [P.V.]

Herbulot, C., "Trois nouveaux *Neocleora* de Guinée et du Cameroun (Lepidoptera Geometridae)" [in French]. *Bull. Inst. franç. Afr. noire,* (*A*) 23: pp.493-495, 3 figs. 1961. Describes as new *N. toulgoetae* (French Guinea, Tondon); *N. dargei* and *N. boetschi* (both from Cameroons, Nlong). [P.V.]

Herbulot, C., "Nouveaux Geometridae d'Aldabra" [in French]. *Rev. franç. Ent.,* vol.29: pp.235-237. 1962. Description of new geometrids from Aldabra Is. in the Indian Ocean: *Chloroclystis oceanica, Problepsis reducta, Comostolopsis stillata modesta, Colocleora acharis.* [P.V.]

Herbulot, C., "Mise à jour de la liste des Geometridae de France (suite)" [in French]. *Alexanor,* vol.3: pp.17-24. 1963. Continuation of up-to-date list of the French Geometridae. [P.V.]

Hering, Erich M., "Eine neue Oecophoriden- Gattung mit Geäder-Dimorphismus aus Argentinien (Lep. Oecoph.)" [in German; Spanish summary]. *Acta zool. lilloana,* vol.15: pp.297-301, 1 fig. 1958. Describes as new *THEAMA,* & type *T. argyrophorum* (Tucuman; reared from leaves of *Talinum patens*). Male hind wing venation modified in association with scent organ. [P.B.]

Hering, Erich M., "Neue Microlepidopteren von Tucumán" [in German; Spanish summary]. *Acta zool. lilloana,* vol.15: pp.303-312, 16 figs. 1958. Describes as new: (Heliodinidae) *WYGODZINSKYIANA,* & type *W. amphilophii* (reared from *Amphilophium vauthieri*); (Gracillaridae) *Lithocolletis solani* (*Solanum* sp.); (Lyonetiidae) *Phyllocnistis baccharidis* (*Baccharis* sp.), *P. wygodzinskyi* (undetermined composite), *P. abatiae* (*Abatia stellata*). [P.B.]

Hering, E. M., "Die erste Chrysopolomide von Madagascar (Lep.)" [in German]. *Bull. Soc. ent. France,* vol.65: pp.302-306, 4 figs. "1960" [1961]. Discovery of Chrysopolomidae in Madagascar; describes the new genus and species *VIETTE-OPOLOMA madagascariensis* (E. Madagascar, integral nategral reserve no.3). [P.V.]

Hering, Erich M., "Neue Blattminen-Studien III (Dipt., Lep.)" [in German]. *Deutsche ent. Zeitschr.,* N. F., vol.10: pp.221-250, 17 figs. 1963. Redefines *Acrolepia perlepidella,* mining in *Inula conyza,* & gives biological notes on this sp. & some relatives. Foodplant records for *Bucculatrix petryi, Scrobipalpa obsoletella, Coleophora* spp., & *Lithocolletis* spp.; taxonomic & biological notes on *Elachista cerusella.* [P.B.]

Heslop, I. R. P., "Revised indexed check-list of the British Lepidoptera. Parts II-VI". *Ent. Gazette,* vol.11: pp.225-234; vol.12: pp.97-108, 199-230; vol.13:

pp.86-91, 185-204; vol.14: pp.48-78. 1960-1963. List of 1434 spp. of micros, general remarks, & indexes. [P.B.]

Heuser, Rudolf, "Beobachtungen und Untersuchungsergebnisse an Faltermaterial der Gattung *Procris* F. aus dem Gebiet der Pfalz" [in German]. *Nachrichtenbl. bayer. Ent.*, vol.11: pp.88-92, 6 figs. 1962. Distinguishes *P. lutrinensis* from *P. statices* in structure & biology. [P.B.]

Hodges, Ronald W., "The genus *Ithome* in North America north of Mexico (Walshiidae)." *Journ. Lepid. Soc.*, vol.15: pp.81-90, 12 figs. 1962. Describes as new *I. edax* (Brownsville, Texas), *I. lassula* (Key West, Florida), *I. ferax* (Siesta Key, Sarasota Co., Florida).

Hoffmeyer, Skat, & S. Knudsen, "*Lycaena alcon* og *L. rebeli*" [in Danish]. *Flora og Fauna*, vol.53: pp.47-48. 1947. The authors mention a series of differences between the two very closely related blues. [T.W.L.]

Hoffmeyer, Skat, "*Strigilis*-gruppen i Finland og Danmark" [in Danish]. *Flora og Fauna*, vol.58: pp.77-78, 1952. Compares Danish & Finnish forms of *Oligia strigilis* & *O. latruncula*. [T.W.L.]

Hogue, Charles L., "Transfer of *Xanthothrix stagmatogon* to *Rolua* and notes on the genus." *An. Inst. Biol. Univ. Mexico*, vol.33: pp.231-234, 2 figs. 1962. Includes comparison of *R. stagmatogon* with the type species, *R. monetifera*. [P.B.]

Hogue, Charles L., "A definition and classification of the Tribe Stiriini (Lepidoptera: Noctuidae)." *Los Angeles Co. Mus. Contr. Sci.*, no.64: 129 pp., 32 pls. 1963. Describes as new *CHICHIMECA* (type *Eulithosia thoracica*); *CUAHTEMOCA* (type *Chalcopasta chalcocraspedon*); *Plagiomimicus bajae* (Punta Prieta, Baja California, Mexico); *Cirrhophanes hoffmani* (Bolsas, Guerrero, Mexico); *Basilodes inquinatus* (Tehuacan, Puebla, Mexico). Detailed description of adult morphology of *Basilodes rugifrons;* discussion of morphological characters & phylogeny; definitions of tribe, genera, & species groups, & key to latter. 96 spp. are assigned to 27 species groups in 8 genera. 4 spp. are included in the tribe but not assigned to genera, and some 20 which were previously included here are placed elsewhere. This poorly known tribe occurs in North and Central America, especially in arid regions. [P.B.]

Holst, Preben L., "To nye danske sommerfugle: *Manhatta biviella* Z. og *Acrobasis tumidana* Schiff." [in Danish; English summary]. *Ent. Meddelelser,* vol.31: pp.123-216, 1 pl. 1961. New Danish records; figures ♂ & ♀ genitalia of these spp. & *A. tumidella*. [P.B.]

Holst, Preben L., "*Ephestia moebiusi* Rbl. (Lepidoptera, Phycitidae) in Denmark." *Ent. Meddelelser,* vol.31: pp.236-241, 2 pls. 1962. Redescribes this species, previously known only from Dresden. [P.B.]

Holst, Preben L., "*Tortrix unitana* Hb., a distinct species." *Ent. Meddelelser,* vol.31: pp.303-310, 24 figs. 1962. *T. unitana,* hitherto regarded as a pale form of *T. paleana,* is shown to be a distinct species, both superficially and genitalically different. [T.W.L.]

Hovanitz, William, "*Argynnis* and *Speyeria*." *Journ. Res. Lepid.*, vol.1: pp.95-96. 1962. Prefers to use *Argynnis* with *Speyeria* as subgenus for nearctic spp. [P.B.]

Hovanitz, William. "Geographic distribution and variation of the genus Argynnis. I. Introduction. II. *Argynnis idalia*." *Journ. Res. Lepid.*, vol.1: pp.117-123, 2 pls., 1 map. 1963. Gives reasons for using *Argynnis* in broad sense. Speculates on origin of South American spp. Figures *A. idalia* in color & maps distribution; no geographic variation. [P.B.]

Hovanitz, William, "The relation of *Pieris virginiensis* Edw. to *Pieris* napi L. Species formation in *Pieris*?" *Journ. Res. Lepid.*, vol.1: pp.124-134, 2 pls., 1 map. 1963. Compares *P. virginiensis* & *P. napi oleracea* in appearance & habits & maps ranges in NE United States. The populations are allopatric, probably because of differences in foodplant & preferred habitat, and there is little intergradation, but for convenience both are regarded as ssp. of *P. napi*. [P.B.]

Howarth, T. G., "Further notes on *Acraea cerasa* Hewitson (Lepidoptera, Nymphali-

dae) and some corrections to a previous paper." *Entomologist*, vol.93: pp.184-185. 1960. Sinks *A. c. kigezia* to *A. c. cerita;* gives revised distribution of latter & of typical race. [P.B.]

Howarth, T. G., "The Rhopalocera of Rennell and Bellona Islands." *Natural History of Rennell Island*, vol.4: pp.63-83, 10 pls. 1962. Describes as new: (Pieridae) *Cepora perimale radiata* (Matahenua, Bellona Is.); (Danaidae) *Danaus philene albonotata* (Tingoa, Rennell Is.); *Euploea fraudulenta addenda* (Matahenua), *E. nemertes bellona* (Matahenua); (Nymphalidae) *Phalanta alcippe rennellensis* (Hutuna, Rennell Is.), *P. a. bellona* (Matahenua); *Precis hedonia parvipuncta* (Hutuna); *Hypolimnas antilope albomela* (Hutuna), *H. pithoeka bradleyi* (Hutuna), *H. p. ferruginea* (Matahenua), *H. alimena libateia* (Hutuna), *H. a. diffusa* (Matahenua); *Doleschallia bisaltide rennellensis* (Hutuna); (Lcaenidae) *Catochrysops panorus rennellensis* (Huntuna), *C. amasea reducta* (Hutuna); *Catopyrops keira reducta* (Te-Hakanggava, Rennell Is.). Records of 32 spp. or sspp. in all (no papilionids, 1 hesperiid). Study based on all material collected on these islands. [P.B.]

Huggins, H. C., "A new subspecies of *Eupithecia venosata* Fabr." *Ent. Rec. & Journ. Var.*, vol.74: pp. 171-172. 1962. Describes as new *E. v. plumbea* (Inishvickilaun, Co. Kerry, Ireland). [P.B.]

International Commission on Zoological Nomenclature, "Opinion 703. *Pterophorus* Schäffer, 1766 (Insecta, Lepidoptera): addition to the Official List of Generic Names." *Bull. zool. Nomencl.*, vol.21: pp.113-115. 1964. Type species, *P. pentadactyla*, & Pterophoridae, also on Official Lists. [P.B.]

Ishihara, Tamotsu, "Two noteworthy species of Lycaenidae found in Mt. Ishizuchi, Shikoku (Lepidiptera)." *Trans. Shikoku ent. Soc.*, vol2: pp.49-50, 4 figs. 1951. Figures of *Neozephyrus hisamatsusanus* & *Favonius fujisanus.* [P.B.]

Issekutz, László, "*Chamaesphecia hungarica* Tomala: bona species" [in Hungarian; English description]. *Folia ent. hung.*, n.s., vol.3: pp.49-55, 8 figs. 1950. The species described as *Sesia empiformis* var. *hungarica* by Tomala, 1901, is a good species. The author gives the description of the imago and caterpillar also. The sp. occurs in Hungary in the areas of the Danube and the Tisza rivers. [J.M.]

Issekutz, László, "*Thyris fenestrella* Scop. und ihre Unterarten" [in German; Hungarian summary]. *Folia ent. hung.*, n.s., vol.6: pp.185-196, 6 figs. 1953. Two new subspecies are described: *T. f. seminigra* (Bükk Mts., N. Hungary) & *T. f. infuscata* (Herkulesfürdö, SW Rumania). [J.M.]

Issekutz, László, & Lájos Kóvacs, "Die *athalia*-Gruppe der Gattung *Melitaea*, mit besonderer Berücksichtigung von *Melitaea britomartis* Assm." [in Hungarian; German summary]. *Folia ent. hung.*, n.s., vol.7: pp.133-146. 1954. The authors discuss 3 new sspp. of *M. britomartis* described (in *Ann. hist.-nat. Mus. nation. hung.*, vol.5: pp.287-303, 1954) from Hungary. [J.M.]

Issekutz, László, "Sammeln, Züchten und Futterplanzen der Glasflügler (Aegeriidae-Sesiidae)" [in Hungarian; German summary]. *Folia ent. hung.*, n.s., vol.8: pp.57-72. 1955. The author describes the methods of collecting and breeding of Sesiidae. He also gives information on types of *Chamaesphecia hungarica* (holotype from Budapest, Hungary). [J.M.]

Janković, M., D. Zečević, & V. Vojinović, "Races of the gypsy moth in Yugoslavia" [in Serbian; English summary]. *Plant Protection*, Belgrade, vol.56: pp.99-107. 1959. *Lymantria dispar.*

Janmoulle, Eduard, "Notes sur les microlépidoptères de Belgique. V. Révision des exemplaires belges des genres: *Homoeosoma* Curtis (part.) (Pyralidae, Phycitinae), *Oxyptilus* Zeller (s.l.) (Pterophoridae), *Cnephasia* Curtis (part.) (Tortricidae, Tortricinae), *Bactra* Stephens (Tortricidae, Olethreutinae)" [in French]. *Bull. Inst. Roy. Sci. nat. Belg.*, vol.35, no.27: 32 pp., 25 figs. 1959. Discusses the 30 spp. of these genera previously attributed to the Belgian fauna, figuring parts of ♂ genitalia and assigning spp. to genera according to recent revisions. 10 spp. are excluded as based on misdeterminations, and 2 spp. (*H. saxicola, Nephodesme incanana*) are newly recorded. [P.B.]

Jørgensen, P. L., "Nogle vanskeligt adskillelige arter" [in Danish]. *Lepidoptera,* 1949: pp.87-90, 16 figs. States the differences between the species of *Apamea, Oporinia* and others. [T.W.L.]

Juul, Knud, *Nordens Eupithecier* [in Danish; English text for each epecies]. 145 pp., ill. Århus. 1948. Hondbook of the *Eupithecia* of Scandinavia and Finland, with pictures of all imagines and ♂ genitalia. [T.W.L.]

Kaaber, Svend, "*Aricia allous* i Jylland" [in Danish; German summary]. *Flora og Fauna,* vol.66: pp.81-88, 3 figs. 1960. Describes the differences between *A. allous* and *A. agestis* and the distribution in Scandinavia. [T.W.L.]

Kaaber, Svend, & O. Høegh-Guldberg, "*Aricia allous* ssp. *vandalica* nov" [in Danish; German summary]. *Flora og Fauna,* vol.67: pp.122-128, 3 figs. 1961. Description of a new subspecies, holotype Tornby Strand, North Jutland, Denmark; types in Natural Museum, Aarhus. [T.W.L.]

Kapoor, M. S., "Studies on the bionomics and control of *Bissetia steniellus* Hampson in the Punjab." *Indian Journ. Ent.,* vol.19: pp.132-143, 181-191. 1957. Includes short section on the synonymy of the species. [J.D.]

Kasy, F., "*CALYCIPHORA,* ein neues Subgenus; *klimeschi, ivae, homoiodactyla,* drei neue Arten des Genus *Aciptilia* Hb. (Lep., Pteroph.)" [in German]. *Zeitschr. wiener ent. Ges.,* vol.45: pp.174-187, 1 pl., 15 figs. 1960. Describes as new *A.* (*CALYCIPHORA*) (type *xanthodactyla* Treitschke), *A.* (*C.*) *klimeschi* (Pecs, S. Hungary; reared from *Jurinea mollis*); *A. ivae* (Drenovo bei Kavadar, W. Macedonia), *A. homoiodactyla* (Fiume). [P.B.]

Kasy, F., "Über die systematische Stellung von *Chilopselaphus podolicus* Toll 1942 (Lepid., Gelechiidae) und dessen neu entdecktes Vorkommen in Neusiedler Seegebiet" [in German]. *Zeitschr. wiener ent. Ges.,* vol.47: pp.25-28, 4 figs. 1962. Reduced to ssp. of *C. balneariellus; C. fallax* compared. [P.B.]

Kasy, F., "Eine neue *Tischeria* aus dem südöstlichen Mitteleuropa (Lep., Tisch)" [in German]. *Zeitschr. wiener ent. Ges.,* vol.14: pp.169-171, 1 pl., 2 figs. 1961. Describes as as new *T. szoecsi* (Zitzmannsdorfer meadows, S. of Weiden am See, N. Burgenland, Austria), [P.B.]

Kasy, Fritz, "Zwei neui neue *Scythris*-Arten aus Südwesteuropa" [in German]. *Ann. naturhist. Mus. Wien,* vol.65: pp.167-171, 6 figs. 1962. Describes as new *S. vartianae* (Sierra Alfacar, near Granada, Spain), *S. strouhali* (Caralps, near Ribas, Pyrenees, Spain). [P.B.]

Kasy, Fritz, "Das Männchen von *Coleophora pseudorepentis* Toll 1960" [in German]. *Ann. naturhist. Mus.. Wien,* vol.66: pp.357-359, 3 figs. 1963. First description of ♂. [P.B.]

Kasy, F., "Ergebnisse der Zoologischen Nubien-Expedition 1962. Teil XIII. Lepidoptera: Noctuidae-Quadrifinae, Lasiocampidae, Sphingidae, Arctiidae" [in German]. *Ann. naturhist. Mus. Wien,* vol.66: pp.463-467, 1 fig. 1963. Records of 16 noctuids (including description of undetermined specimen of *Crypsotidia*) & 7 other spp., from upper Nile valley. [P.B.]

Kernbach, Kurt, "Beitrag zur Kenntnis einiger afrikanischer Sphingiden (Lep. Sphingidae)" [in German]. *Deutsche ent. Zeitschr.,* N. F., vol.10: pp.164-174, 16 figs. 1963. Describes as new *Polyptychus marshalli meridianus* (Umtalli, S. Rhodesia). Gives additional description of some spp of *Pemba, Praedora, Libyoclanis, Polyptychus,* & *Nephele.* [P.B.]

Kiriakoff, S., G., "On the typical specimens of Thyretidae (Lepidoptera: Notodontoidea) in the Zoological Museum, Humboldt University, Berlin." *Ent. Berichten,* vol.19: pp.186-190, 3 figs. 1959. Notes on specimens described by Strand & by Seitz, with new synonymy; genitalic figures of *Diakonoffia rubicundula, Melisoides lobata,* & *Metarctia lugubris.* [P.B.]

Kiriakoff, S. G., "*NESOPTILURA malgassica* gen. spec. nov., un nouveau notodontide malgache" [in French]. *Lambillionea,* vol.60: pp.90-93, 1 fig. 1960. Type locality: Antsoa valley, 100 m., Montagne des Français, Diego Suarez district, Madagascar. [P.B.]

Kiriakoff, S. G., "Die Thyretidae (Lepidoptera: Notodontoidea) der Zoologischen Staatssammlung München. II. Beitrag" [in German]. *Mitt. münchner ent. Ges.*, vol.51: pp.96-110, 1 pl., 9 figs. 1961. Describes as new *Apisa* (*A.*) *hildae* (Okahandja, SW Africa); *Rhipidarctia* (*R.*) *crameri* (Masindi, Uganda); *Metarctia* (*Metarhodia*) *heinrichi* (Canzele, 30 km. N. of Quicolungo, Nordcuanza Prov., NW Angola), *M.* (*Metarhodia*) *confederationis* (Karkloof, Natal), *M.* (*Metarctia*) *lindemannae* (Sakarani, 1500 m., Usambara Mts., Tanganyika), *M.* (*Metarctia*) *sheljuzhkoi* (Abidjan, Ivory Coast), *M.* (*Collocaliodes*) *pavlitzkae* (Sakarani); *Balacra* (*B.*) *rubrovitta angolensis* (Bolongongo, SE Angola). Records of 33 other with some descriptive notes. [P.B.]

Kiriakoff, S. G., "Thyretidae neuveaux (Lepidoptera: Notodontoidea)" [in French]. *Lambillionea*, vol.61: pp.7-12, 5 figs. 1961. Describes as new *Diakonoffia nigrita* (Uele, Paulis); *Rhipidarctia* (*Elsita*) *forsteri ruandae* (Ruanda, Kisenyi); *Metarctia* (*M.*) *paulis* (Uele, Paulis), *M.* (*M.*) *venustissima* (Katanga, Kolwezi); *Bergeria octava* (Ubangi, Bumba region). [P.B.]

Kiriakoff, S. G., "La Réserve naturelle intégrale du Mont Nimba — XVII. Lepidoptera Heterocera (Anthroceridae, Arctiidae, Thyretidae, Notodontidae)" [in French]. *Mém. Inst. franç. Afrique noire*, no.66: pp.401-409. 1963. List of species belonging to these families collected in the integral natural reserve of Mt. Nimba (French Guinea). Describes as new: *Doratopteryx dissemurus* (Anthroceridae); *Psichotoe cingulata* (Arctiidae Amatinae); *Ceryx lamottei* (id.); *Ulinella royi* (Notodontidae); *Scrancia tridens* (id.), *S. bicolor*. [P.V.]

Kiriakoff, Sergius G., "On the systematic position of the so-called subfamily Platychasmatinae Nakamurua, 1956 (Notodontidae)." *Journ. Lepid. Soc.*, vol.17: pp.33-34, 2 figs. 1963.

Kiriakoff,Sergius G., "The tympanic structures of the Lepidoptera and the taxonomy of the order." *Journ. Lepid. Soc.*, vol.17: pp.1-6. 1963.

Klimaszewski, Sedzimir Maciej, "Studien über mitteleuropäischen Arten der Gattung *Cosymbia* Hbn. (Lepidoptera, Geometridae)" [in Polish; Russian & German summaries]. *Fragm. faun. Inst. zool. Polska Akad. Nauk*, vol.8: pp.447-467, 7 pls. 1960. Describes & figures ♂ & ♀ genitalia of 11 spp., & gives keys based on genitalia. [P.B.]

Kostrowicki, Andrzej Samuel, "Sowki — Noctuidae. Wstep i podrodzina Cuculliinae" [in Polish]. *Klucze do Oznacz. Owadów Polski*, vol.27, part 53a (no.15); 124 pp., pp., 441 figs. 1956. See review in *Journal*, vol.15: p.132.

Kostrowicki, Andrzej Samuel, "Sowki — Noctuidae. Podrodziny Agrotinae, Melicleptriinae" [in Polish]. *Klucze do Oznacz. Owadow Polski*, vol.27, part 53b (no.28); 145 pp., 429 figs. 1959. See reciew in *Journal*, vol.15: p.132.

Kostrowicki, Andrzej Samuel, "Studien über die Familie Phalaenidae s.l. (Lepidoptera). I. Beschreibungen von zwei neuen Arten, samt Angaben über Morphologie und Verbreitung von einigen weiteren Arten der Familie Phalaenidae" [in German; Polish & Russian summaries]. *Ann. zool. Polska Akad. Nauk*, vol.21: pp.23-30, 1 pl., 23 figs. 1963. Describes as new *Cucullia kozhantshikovi* (Amur); *Tholera gracilis* (Jerusalem). Notes on *C. fraterna*, *C. wredowi*, & *Epia podolica*, n.comb. [P.B.]

Kovács, Lájos, "*Chloridea maritima* Grasl. und *dipsacea* L. in Ungarn" [in German; Hungarian summary]. *Folia ent. hung.*, n.s., vol.3: pp.66-70. 1950. The distribution and life-history of both spp. in Hungary. Describes as new *C. maritima hungarica* ssp.n. (Hungary, Rumania and Slovakia). [J.M.]

Kovács, Lájos, "Neue Arten und Varietäten in der ungarischen Macrolepidopteren-Fauna" [in Hungarian; German summary]. *Folia ent. hung.*, n.s., vol.7: pp.53-64, 6 figs. 1954. Records some spp. new for Hungary and discusses a new sp., *Sarrothripus hungarica*, and a new sspp., *Gnophos intermedia budensis* (the original descriptions are published in *Ann. hist.-nat. Mus. nation. hung.*, n.s., vol.5: pp.305-315. 1954.). [J.M.]

Kovács, Lájos, "Systematische, ethologische und fenologische Angaben über *Euphya frustata* Tr." [in Hungarian; German summary]. *Folia ent. hung.*, vol.9: pp.459-470. 1956. The species lives in Hungary in 2 generations. [J.M.]

Kruseman, G., "*Anaea leonida* (Cr.) (Lep.)" [in Dutch; English summary]. *Ent. Berichten*, vol.18: pp.176-177, 1 fig. 1958. Figures lectotype & only recent specimen, from Surinam. [P.B.]

Krzywicki, Miecyslaw, "Modraszki – Lycaenidae, Wieleny – Erycinidae" [in Polish]. *Klucze do Oznacz. Owadów Polski*, vol.27, part 61-62 (no.31); 64 pp., 73 figs. 1959. See review in *Journal*, vol.15: p.132.

Krzywicki, Mieczyslaw, "Pieridae – Papilionidae" [in Polish]. *Klucze do Oznacz. Owadów Polski*, nos. 65/66: 45 pp., 59 fig. 1962. See review in Journal, vol.16: p.92.

Krzywicki, Mieczyslaw, "Beitrag zur Rhopaloceren-Fauna des Polnischen Teiles des Tatra-Gebirges (Lepidoptera)" [in Polish; Russian & German summaries]. *Ann. zool. polska Akad. Nauk*, vol.21: pp.151-222, 7 pls., 6 figs. 1963. Describes as new *Parnassius apollo niesiolowskii* (Berg Zar, Tatras); *Boloria pales ignita* (Tomanowa Wyznia, Tatras); & a var. of *Erebia aethiops*. Review of butterfly fauna of Polish Tatra based on 40 years' collecting. [P.B.]

Kumata, Tosio, "Redescriptions of the species of the genus *Lithocolletis* described by Prof. Dr. S. Matsumura (Lepidoptera, Gracilariidae)." *Insecta matsumurana*, vol.22: pp.71-81, 4 figs. 1959. Redescribes *L. ringoniella*, *L. bicinctella*, & *L. jezoniella*; selects lectotypes. [P.B.]

Kumata, Tosio, "Synonymic notes on a gracillariid moth." *Insecta matsumurana*, vol.25: p.136. 1963. Sinks *Dryadolla ainoniella* to *Leucospilapteryx omissella*; reared from *Artemisia*. [P.B.]

Kumata, Toshio, "Taxonomic studies on the Lithocolletinae of Japan (Lepidoptera: Gracillariidae). Part I." *Insecta matsumurana*, vol.25: pp.53-90, 24 figs. 1963. Describes as new: *Lithocolletis styracis* (Hikosan, Kyusyu; on *Styrax japonica*), *L. juglandis* (Sapporo, Hokkaido; on *Juglans ailantifolia*), *L. pterocaryae* (Gamusi, Hiyama, Hokkaido; on *Pterocarya rhoifolia*), *L. issikii* (Sapporo; on *Tilia* spp.), *L. maculata* (Saporro; on *Alnus hirsuta*), *L. takagii* (Toyama, Honsyu; on *Alnus japonica*), *L. carpini* (Nopporo, Hokkaido; on *Carpinus laxiflora*), *L. ostryae* (Sapporo; on *Ostrya japonica*), *L. hikosana* (Hikosan; on *Carpinus tschonoskii*), *L. ermani* (Zyôzankei, Hokkaido; on *Betula ermani*), *L. japonica* (Sapporo; on *Carpinus* spp.). *L. dakekanbae* (Sapporo; on *B. ermani*), *L. fagifolia* (Hikosan; on *Fagus crenata*), *L. acutissimae* (Nagano, Honsyu; on *Quercus acutissima*), *L. kamijoi* (Nagano; on *Q. acutissima*), *L. pseudolautella* (Otaki, Nagano-ken, Hyonsyu; on *Quercus* spp.), *L. pygmaea* (Sapporo; on *Quercus* spp.), *L. rostrispinosa* (Hikosan; on *Q. serrata*); *L. mongolicae* (Wakkanai, Hokkaido; on *Quercus* spp.). Notes on 12 other spp., with host plant records & some descriptions of adults & mines. [P.B.]

Kumata, Tosio, "Taxonomic studies on the Lithocolletinae of Japan (Lepidoptera: Gracillariidae). Part II." *Insecta matsumurana*, vol.26: pp.1-48, 27 figs. 1963. Describes as new: *Lithocolletis zelkovae* (Kitahukuoka, Iwate-ken, Honsyu; on *uelkova serrata*), *L. ulmi* (Sapporo, Hokkaido; on *Ulmus davidiana*), *L. celtidis* (Hikosan, Kyusyu; on *Celtis sinensis*), *L. pulchra* Hikosan; on *Rubus illecebrosus*), *L. aino* (Tomakomai, Hokkaido; on *Spiraea salicifolia*), *L. watanabei* (Tomakomai, on *Pourthiaea villosa*), *L. sorbicola* (Sapporo, Hokkaido; on *Sorbus matsumurana*), *L. uchidai* (Sapporo; on *Sorbus alnifolia*), *L. viciae* (Esasi, Hokkaido; on *Vicia japonica*), *L. kurokoi* (Hikosan, Kyusyu; on *Acer mono*), *L. orientalis* (Zyôzankei, Hokkaido; on *Acer mono*), *L. melanocoronis* (Hikosan; on *Rhododendron*), *L. lyoniae* (Ino, Kôti-ken, Sikoku; on *Lyonia ovalifolia*), *L. lonicerae* (Asizuri-misaki, Kôti-ken; on *Lonicera japonica*), *L. viburni* (Hikosan; on *Viburnum erosum*), *L. turugisana* (Turugisan, Sikoku), *L. gigas* (Kamikôti, Nagano-ken, Honsyu); *NEOLITHOCOLLETIS*, & type *N. hikomonticola* (Hikosan; on *Pueraria lobata*); *HYLOCONIS*, & type *H. puerariae* (Teine, Hokkaido; on *Pueraria lobata*),

H. desmodii (Hikosan; on *Desmodium racemosum*), *H. lespedezae* (Sapporo; on *Lespedeza bicolor*), *H. wisteriae* (Ino, Kôti-ken, Sikoku; on *Wisteria floribunda*); *Cameraria acericola* (Teine, Hokkaida; on *Acer mono*), *C. niphonica* (Hikosan; on *Acer*), *C. hikosanensis* (Hikosan; on *Viburnum erosum*). Redescribes or gives notes on 6 other spp. of *Lithocolletis*. [P.B.]

Kumata, Tosio, "Taxonomic studies on the Lithocolletinae of Japan (Lepidoptera: Gracillariidae). Part III." *Insecta matsumurana*, vol.26: pp.69-88, 8 pls. 1963. Redefinition of subfamily and Japanese genera; species lists, host plant lists, & keys to genera & spp.; numerous figures of forewings, venation, & mines. Redescribes *Lithocolletis spinalella*, new for Japan. [P.B.]

Kuroko, Hiroshi, "Notes on the *Liocrobyla* of Japan, with descriptions of two new species (Lepidoptera, Gracilariidae)." *Esakia*, no.1: pp.1-7, 3 pls., 8 figs. 1960. Describes as new *L. lobata* (Mt. Hikosan, N. Kyusyu; on *Paueraria lobata*), *L. brachybotrys* (Mt. Hikosan; on *Wisteria brachybotrys*). Redescribes *L. paraschista*. [P.B.]

Kuroko, Hiroshi, "On a new subspecies and an unrecorded species of the genus *Cosmopterix* from Japan (Lepidoptera, Cosmopterigidae)". *Esakia*, no.1: pp.9-12, 1 pl. 1960. Describes as new *C. scribaiella japonica* (Mt. Hikosan, N. Kyusyu; from *Phragmites communis*) redescribes *C. eximia*, new to Japan, bred from *Boehmeria* & *Humulus*. [P.B.]

Kuroko, Hiroshi, "Descriptions of *Microsetia sexguttella* Thunberg and its allied new species from Japan (Lepidoptera, Gelechiidae)." *Esakia*, no.3: pp.1-8, 3 pls., 5 figs. 1961. Describes as new *M. heringi* (Mt. Hikosan, N. Kyusyu; bred from *Achyranthes japonica*). Redescribes *M. sexguttella;* describes larva & biology of *M. heringi*. [P.B.]

Kuroko, Hiroshi, "The genus *Antispila* from Japan, with descriptions of seven new species (Lepidoptera, Heliozelidae)." *Esakia*, no.3: pp.11-24, 6 pls., 9 figs. 1961. Redefines genus & gives key to the seven Japanese spp., all described as new here: *A. orbiculella* (Mt. Hikosan, N. Kyusyu; from *Ampelopsis brevipedunculata*), *A. ampelopsia* (Mt. Hikosan; from *A. brevipedunculata*), *A. corniella* (Mt. Hikosan; from *Cornus* spp.), *A. iviella* (Miyanoura, Yakushima; from *Parthenicissus tricuspidata*), *A. hikosana* (Mt. Hikosan; from *Cornus* spp.),*A. hydrangifoliella* (Mt. Hikosan; from *Hydrangea* spp.), *A. purplella* (Mt. Hikosan; from *Cornus* spp.). Gives notes on biology & figures larval cases. [P.B.]

Laffoon, Jean L., "Common names of insects. Additions, changes and corrections in the list approved by the Entomological Society of America." *Bull. ent. Soc. Amer.*, vol.7: p.93. 1961.

Langer, T. W., "I. C. Fabricius og hans Systema Entomologiae" [in Danish]. *Flora og Fauna*, vol.60: pp.113-117. 1954. A critical review of the Lepidoptera mentioned in *Systema Entomologiae* and of some of the Linnean names and their application today. [T.W.L.]

Langer, T. W., "De linneanske sommerfuglenavne af 1758" [in Danish]. *Svenska Linné-Sällskapets* Årsskrift, vol.41: pp.51-60. 1958. The 49 butterfly names in *Systema naturae* have been given by Linnaeus in the order of priority: 1. after the plant, 2. after exaernal characters, 3. after mythological persons. All apparent exceptions have been elucidated. [T.W.L.]

Langer, T. W., "Siamesiske tvillingearter, et nyt begreb i simmerfugle terminologien" [in Danish]. *Naturens Verden*, 1960: pp.254-256. The genetic relationship in groups like *eurytheme-philodice-chrysotheme, napi-bryoniae-melete* and others. [T.W.L.]

E. DISTRIBUTION AND PHENOLOGY

Eidmann, H., "Grundsätzliches über die Ursachen der Verbreitung und Populationsdichte der Insekten" [in German]. *Zool. Anz.*, suppl. no.13 (*Verhandl. deutschen Zool.* 1948 *in Kiel*): pp.359-365, 3 figs. 1949. Explains range limitations in monophagous Lepidoptera by combination of climatic tolerance and foodplant range. [P.B.]

Ekström, Martin, "Lepidopterologiska notiser från Gotland" [in Swedish; German summary] *Opusc. ent.*, vol.15: pp.139-142. 1950. *Erastria venustata, Anarsia lineatella, Gelechia muscosella, Blabophanes monachella* new for Sweden. Notes on 7 other spp., new to Gotland. [P.B.]

Emmet, A. M., "*Nonagria algae* Esper (*cannae* Ochs.) (Lep., Caradrinidae) in Ireland." *Entomologist*, vol.87: p.31. 1954. New record.

Ernst, Richard, "Für Österreich neu!" [in German]. *Zeitschr. Wiener Ent.* Ges., vol.36: p.130. 30 June 1952. *Grammodes stolida,* new to Austria. [P.B.]

Esaki, Teiso, "Brief notes on alpine butterflies [of Japan]" [in Japanese]. *New Entomologist*, vol.2: pp.1-7, 2 tables June 1952. 9 spp. in Honshu, 5 in Hokkaido. [T.I.]

Esaki, Teiso, "*Milionia pryeri* Druce, a new pest in Kyushu (Geometridae)" [in Japanese]. *Shin Konchu,* vol.6, no.3: pp.14-15, 1 fig. March 1953. The caterpillars damage *Podocarpus macrophylla* (Podocarpaceae). [T.I.]

Evers, Hans, "Beiträge zur Macrolepidopterenfauna von Sylt" [in German]. *Bombus,* no.39: pp.169-172; correction, ibid. no.53: p.232. 1947; 1948. Annotated list of 80 spp. from NW Germany. [P.B.]

Ext, Werner, "Das Massenauftreten der Gammeule *Plusia gamma* L. in Schleswig-Holstein in Sommer 1946" [in German]. *Zeitschr. Pflanzenkraukh.*, vol.55: pp.75-81. March/April 1948. Report on extent & intensity of outbreak. Practically all crops attacked. [P.B.]

BOOK NOTICE

A REVISION OF THE MELITAEINE GENUS CHLOSYNE AND ALLIED SPECIES (Lepidoptera: Nyphalinae). By L. G. Higgins. Trans. Royal Ent. Soc. London, 112 (14): 381-475, 134 figs. Dec. 31, 1960. 2. 2s. Od. ($5.88). Paper.

Judging from several manuscripts submitted to the *Journal* for publication recently, it appears that a number of members of the Society are unaware of Higgins' revision. This treatment is based on structural characters including genitalia of both sexes, wing venation, and labial palpus. In general the arrangement is similar to that of Bauer (1961, *in* Ehrlich, *How to Know the Butterflies*) for Nearctic species which was in press concurrently.

Higgins ascribes *Melitaea* F. to the North American fauna for *minuta* Edw. and allies for which Bauer proposed the new genus *Poladryas.* Other noteworthy differences include Higgins' use of *Thessalia* Scudder for *leanira* Feld. & Feld. and *theona* Men., and *Texola* Higgins, 1959, for *elada* Hew., all of which are retained in *Chlosyne* by Bauer. In addition, Higgins proposes a new genus, *Dymasia,* for *dymas* Edw., considering it to be sufficiently distinct from *Microtia elva* Bates. Many differences exist between the two treatments at the specific and subspecific levels; Higgins' concepts include treatment of the Neotropical representatives of the group. Both arrangements should supercede that of dos Passos' list (1964, *Synonymic List of Nearctic Rhopalocera*) where these species are lumped under *Melitaea,* a concept dating back to the time of dos Passos' original manuscript, about 1959. — EDITOR

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(new names in **boldface;** synonyms in *italics*)

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Contributions to the *Journal* may be on any aspect of the collection and study of Lepidoptera. Articles of more than 20 printed pages are not normally accepted; authors may be required to pay for material in excess of this length. Manuscripts must be typewriten, ENTIRELY DOUBLE SPACED, employing wide margins and one side only of white, 8½ x 11" paper. The author should keep a carbon copy of the manuscript. Titles should be explicit and descriptive of the article's content, including an indication of the family of the subject, but must be kept as short as possible. Authors of Latin names should be given once in the text. Format of REFERENCES MUST CONFORM TO EXACT STYLE used in recent issues of the *Journal*. Legends of figures and tables should be submitted on separate sheets. Authors are normally charged for engraving and tables at cost.

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